THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

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THE NEW YORK BOTANICAL GARDEN

DOROTHY EBEL HANSELL
Editor

CALENDAR

May 12, 1960. Spring Garden Tour to Princeton, New Jersey, sponsored by the Volunteer Associates of The New York Botanical Garden.

May 19, 1960. 11 a.m.-6 p.m. Seventh Annual House and Garden Tour for the benefit of the Patients Special Project Fund of the Institute of Physical Medicine and Rehabilitation of New York University-Bellevue Medical Center. For information on tour in Greenwich, Connecticut, and Purchase, New York, call OR 9-3200, Ext. 85.

May 21, 1960. Annual meeting of the American Rock Garden Society at White Hart Inn, Salisbury, Connecticut.

May 24, 1960. 2 p.m. Annual meeting of The New York Botanical Garden at the Garden. (Note change in date from May 16).

June 2, 1960. 10 a.m.-5 p.m. "Historic Morristown and Environs"—home and garden tour of The Garden Club of New Jersey. For tickets, write Mrs. Harry T. Maxwell, 47 Maple Avenue, Morristown, N. J.

June 7, 1960. Eighteenth Annual Rose Day at The New York Botanical Garden. Inspection of Rose Garden, with guest experts, 9:45-11:45 a.m. Afternoon Program, 1:00-3:30 p.m.; T. H. Everett, Assistant Director, (Horticulture) will be moderator of the panel of guest experts. Lunch may be had at the Snuff Mill Restaurant.

June 7, 8, 9, 1960. Ninth District of the Federated Garden Clubs of New York State, Inc., Flower Show School Course V at Memorial Methodist Church, White Plains, New York. For information write Mrs. Ronald W. Yocum, Spring Lane, Chappaqua, New York.

June 18, 1960. Rose Show of Southampton Garden Club at Parrish Memorial Hall, Herrick Road, Southampton, Long Island. Entries accepted from garden clubs and residents of eastern Long Island.

June 21, 1960. Reception for Graduates of the Two-Year Courses in Botany and Practical Gardening at The New York Botanical Garden.

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CREDIT FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Mrs. Richard S. Meredith, Mrs. Donald B. Straus, for the selection of the front cover illustration—the "Ladies' Border" at The New York Botanical Garden, process photography by E. N. Mitchell; pp. 87-90, F. C. Steward; p. 91, Boeing Airplane Co., Seattle; p. 92, 93, H. F. Becker; pp. 95-97, The Lawn Institute, Marysville, O.; p. 98, E. N. Mitchell; p. 101, lower left, Hilary Neighbors; p. 101, upper left and upper right, pp. 102-104, David G. Leach; pp. 105, 106, Albert Lowenfels; pp. 108-112, Howard W. Swift; p. 116, T. H. Everett; p. 117, E. N. Mitchell; p. 118, Jr. and Sr. High School, Cornwall, New York; p. 119, upper, Fay Photo Service, center, Paul E. Geneveux, lower, William Sevecke; p. 120, Edmund B. Gilchrist, Jr.; p. 121, upper, Standard Photo Service, lower, Armstrong Nurseries by Clint Bryant; p. 124, Robert Marshall. Drawings, pp. 99, 100, by Charles Clare, Jr. Diagram p. 106. E. C. Geiger, North Wales, Pa.

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AN APPRAISAL OF

PRESENT AND FUTURE TRENDS IN BOTANY

By **William Campbell Steere**

Excerpts from a paper presented by Dr. Steere, Director of The New York Botanical Garden, at a special symposium of the Botanical Society of America during the meetings of the American Institute of Biological Sciences at Indiana University, August 1958, and originally published in *Plant Science Bulletin*, Vol. 5, No. 3.

MY CONSIDERATION of present trends in botany, leading to some crystal-ball gazing into the future, has been rendered immeasurably easier by my close association with the series of special papers published in the *American Journal of Botany*. Celebrating the fiftieth anniversary of the Botanical Society of America, these papers, reinforced by three additional ones, appeared in book form under the title, *Fifty Years of Botany*. After living—and sleeping — with these papers for over two years, in reading each one in manuscript and in galley and page proofs, I have nearly committed to memory the views and ideas of the forty-some authors—which will explain my frequent reference to them.

The renaissance in taxonomy during the last decade or so—the "New Systematics"—has resulted from the transfusion into classical taxonomy of the data and the techniques of many other fields, as, for example, cytology, genetics, physiology, anatomy, ecology, experimental morphology, geography, biochemistry, and biophysics. Thanks to wise and generous aid from the National Science Foundation, as well as from other agencies, and the dynamic approach of outstanding systematists to their problems, systematic biology is in better health than it has been for decades. Much thought and attention have been given to the philosophical basis of systematic biology by some of the best biologists of the present generation — Anderson, Clausen, Dobzhansky, Huxley, Mayr, Simpson, and Stebbins, among others. . . . .

The very great importance of systematics in modern science has been emphasized recently by the "Report of the Committee on Systematic Biology of the American Institute of Biological Sciences" (1957). . . . Largely the work of the chairman, Ernst Mayr, this report states: "It should not be forgotten that the field of systematic biology continues to make important conceptual contributions to the field of biology as a whole. The great evolutionists, like Lamarck and Darwin, were practicing taxonomists and have themselves attributed their concepts to their background. One of the most important concepts in modern biology, that of the population, has grown out of the experience of practicing taxonomists. A healthy field of systematic biology is a necessity for the balanced development of biology as a whole."

Simpson (1945) summarized the situation very well, too, as follows: "Taxonomy is at the same time the most elementary and the most inclusive part of biology, most elementary because organisms cannot be discussed or treated in a scientific way until some taxonomy has been achieved, and most inclusive because taxonomy in its various guises and branches gathers together, utilizes, summarizes, and implements everything that is known about organisms, whether morphological, physiological, or ecological." The unifying force of systematics in the fields of botany and zoology gives it a transcendental importance as yet too little recognized. . . .

Like systematic botany, plant morphology has also experienced radical changes in its approaches and techniques. Eames (1958) presented an excellent résumé of the remarkable progress in the field of morphology during the past five decades. . . . The change in morphology from a rather narrow descriptive field fifty years ago to its present broad, interpretative, and comparative status is clearly depicted by him, as follows: "The development of comparative study produced new bases for interpretation: the recognition that sound morphology must deal with the entire plant body, with vegetative as well as reproductive parts, with internal as well as external structures; the recognition that simplicity may represent reduction from complexity as well as primitiveness; that parallel and convergent evolution have played an important part in evolutionary modification; that evidence of these changes is as often hidden as obvious and must be obtained from as many fields of research as possible—not from morphology alone, but from taxonomy, cytology, genetics, geography, paleobotany, serology, and other fields."

I have selected my quotations from Eames, Mayr, and Simpson especially carefully in order that each one might illustrate, and all might emphasize cumulatively, the only direction in which systematic and morphological botany can proceed successfully—through the use of all available data from every field of botany or biology, and through the development of broader research interests by individual investigators. . . .

. . .It is obvious that our better botanists, as well as our better taxonomists, must be versatile people with broad interests.

Ledyard Stebbins has reviewed the remarkable upheaval that took place recently in the classification of the grass family through new and significant data supplied by the microscopic anatomy of the leaf epidermis, the number and size of chromosomes, the comparative sensitivity to herbicides, the nature of the seed and its embryo, the development pattern of root hairs, the ecological requirements, and other characters of the plants ignored until recently. Needless to say, parallel investigations on other large and complex families will certainly result in equally revolutionary discoveries.

Edgar Anderson, in his inimitable style, has pointed out the necessity of developing logical basic procedures in those fields, such as taxonomy, where natural history, statistics, and applied mathematics may come together. Through his own brilliant invention, the pictorialized scatter diagram, we have a

relatively simple, precise, semi-graphical and semi-mathematical technique for dealing with multiple-sense-impression problems. . . .

Other and perhaps more familiar examples of the inter-relationships between morphology, taxonomy, and physiology are easy to find. The differences between populations — whether varieties, subspecies, or species—of all plants and animals are important not only in taxonomic terms, but also in the most fundamental biological terms. These differences are expressed by every single aspect of the organism, by its metabolism as well as by its structure. Physiological and biochemical differences are well illustrated by closely related poisonous and edible species of mushrooms in the same genus, by the different aromas and flavors of fruits of closely related species and cultivars of higher plants, and by the difference in color of flowers, not rarely controlled by genetic inheritance of some factors that determines the pH of cell sap. A fuller knowledge of the biochemistry of alkaloids, saponines, volatile oils, carbohydrates, latexes, anthocyanins, flavones, and other common plant compounds will eventually be of the utmost importance to taxonomists, especially within closely knit families and genera. It was no accident, for example, that systematic botanists were selected during World War II for the search for new and old sources of quinine, rubber, and other strategically important plant products in South America.

In the past, we have derived very considerable insight into phylogeny and evolutionary steps through rare and accidental abnormalities. A new approach now may be through artificially induced teratology, which can well open a whole new field of experimental taxonomy. The use of gibberellins to promote growth in plants that are genetically inhibited, and the use of herbicides to inhibit growth in plants that normally produce lush growth might very well expose, hitherto hidden pathways of evolution.

As an administrator for many years in universities, in governmental agencies, and now in a botanical institution, I have become almost unduly sensitive on one question: What is the future of botany? Like all questions this one has two sides: What is the future of botany as such, and What is the future of botany in relation to—and in competition with—other sciences?

. . . The American Institute of Biological Sciences exerts a strong positive force for the identification and maintenance of biology as a united field, in competition with the physical sciences. The National Science Foundation, likewise, supports biology rather than botany, zoology, microbiology, or other biological fields. We must cancel all the long-standing feuds between the experimental and the descriptive biologists, between the physiologists and the taxonomists, between the botanists and the zoologists, and establish ourselves as biologists, or at least as plant scientists who are willing to work diligently and sincerely with others to build firm foundations under the flag of biology. . . . The great present strength of the two major fields of physical sciences, chemistry and physics, stems directly from their homogeneity, their integrity, and their avoidance of the suicidal fragmentation into special fields. . . .I shall make the prediction now that botanists will learn to pull together. . . .to protect the status and prestige of their discipline and to make forward progress as a group.

Equal in importance to the selection of the problem is the nature of the written report that presents the results of the research. . . .The charge leveled against them [morphologists and systematists] that their writings tend to be dull and prosaic has more than a modicum of truth, unfortunately. . . .Without doubt, the present-day high costs of publication and the consequent page limitations enforced by most botanical journals constitute one factor in the production of a near-neurosis in many authors who have developed a cold, sterile, telegraphic style that keeps the reader at arms' length, if not farther. . . .No author should feel apologetic for the occasional use of "I" and without being either verbose or chatty, and still more important without reducing accuracy, an author can by the subtle introduction of his own personality into his writing establish rapport with the reader and thereby stimulate interest. . . .Clear and emphatic writing will become increasingly necessary in a not distant future in which all papers reporting original research and ideas will be abstracted into electronic "memories."...

With the astonishingly rapid development of electronic devices for the storage and transmission of information, I predict that within a relatively short time much of the drudgery and housekeeping work of systematic botanists will be relegated to electronic computers. . . .

I predict that taxonomists will gain much insight into evolution and genetic fluctuations through the effects of controlled and accidental radiation. Taxonomists will certainly be called upon to identify plants that seem to indicate uranium-bearing rocks or soils—in fact, geobotany is already a well-established field. However, the recognition of plants that are unusually sensitive or unusually resistant to excessive radiation is still in the future. It will not be long before we shall need to know which plants may serve as indicators of accumulating fall-out dust and particles. . . .

I predict that privately and publicly supported botanical institutions will gain increasing momentum in basic systematic research. The immense prestige and influence of the Buitenzorg (now Bogor) Botanical Garden in Java for nearly a century as a source of morphological and taxonomic research materials is obvious from even a casual reference of the literature. The increased emphasis on botanical gardens in the last decade is encouraging, as through these institutions a broader base of public support of botany can be obtained. The brilliant success of the Los Angeles State and County Arboretum is the direct result of the guiding genius of Frits Went, for whom I can predict a still greater success at the Missouri Botanical Garden in St. Louis. George Avery has made a great public relations success for botany at the Brooklyn Botanic Garden, that reflects much to his personal credit. The Boyce Thompson Institute, The New York Botanical Garden, the Chicago Natural History Museum, the California Academy of Sciences, the great botanical gardens in London, Berlin, Paris, Copenhagen, Stockholm, Leningrad, and elsewhere in Europe, in Singapore, Borneo, Trinidad, Rio de Janeiro, Jamaica, West Africa, and elsewhere in the tropics are all important as primary loci for basic research or as sources for research material.

I predict the development of even larger and more accurately planned

(Continued on page 94)

CARROTS AND COCONUTS —
SOME INVESTIGATIONS ON GROWTH

By F. C. Steward

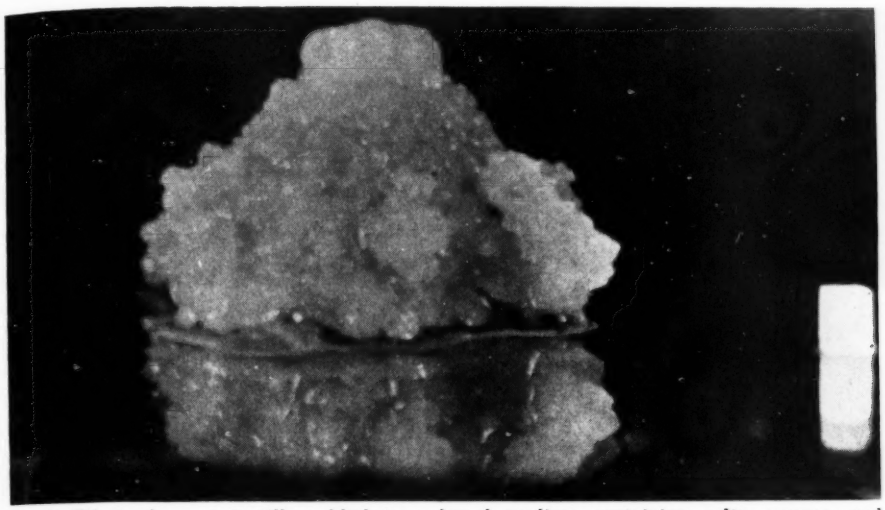


Fig. 1. Effect of coconut milk, added to a basal medium containing salts, sugars, and vitamins, on the growth of an explanted piece of carrot root tissue. Left, growth of tissue in presence of coconut milk; right, growth of tissue without coconut milk.

Dr. Steward has been Professor of Botany at the New York State College of Agriculture, Cornell University, Ithaca, New York, since 1950. Before that he was Chairman of the Department and Professor of Botany at the University of Rochester, Rochester, New York, and Lecturer at Leeds University and Reader at the University of London, England. He is a Fellow of the Royal Society of London.

The following is an abstract of the talk that Dr. Steward gave at the Fourteenth Annual Horticultural Congress in Rochester, New York, in October 1959. It is illustrated by reproductions of some of the slides accompanying his talk. The work has been supported by grants from the National Cancer Institute of the United States Public Health Service, and this account summarizes published and unpublished research in which a number of collaborators and technical assistants have participated, especially Drs. Caplin, Pollard, and Shantz, Miss Kathryn Mears, and Mrs. Marion O. Mapes.

IN ANY sexually reproduced organism the capacity to grow is "built into" the fertilized egg. In part this capacity to grow derives from the stimulus which follows the act of fertilization; in part it results from the special nutrition which the young embryo receives. These special nutrients may be supplied (in plants) by the often liquid contents of the embryo sac and of a special nutritive tissue known as endosperm. We need to know, therefore, the special stimuli which are supplied by these "nursing-organs" in plants which enable the embryos to develop.

The experimental materials that have been studied consist of living cells that would not normally divide again in the plant body, but in which, nevertheless, growth can be induced. These cells are found in the root of the carrot sufficiently far from the growing tissue (the cambium) so that in the normal way they would not divide again in the intact root. A series of events that need not be recounted led, some years ago, to the placing, aseptically, of pieces of carrot tissue in a nutrient medium complete with salts, sugars, and vitamins, but also supplemented with coconut milk. Coconut milk is the liquid endosperm of the coconut.

In the presence of the coconut milk the cells entered upon a very rapid, almost explosive, growth rate. In the absence of the coconut milk, though supplied with all ordinary nutrients, they grew very slowly, or not at all (Fig. 1). The interest of this observation is in the fact that the coconut milk, or liquid endosperm of the coconut, is the material that normally nourishes the immature

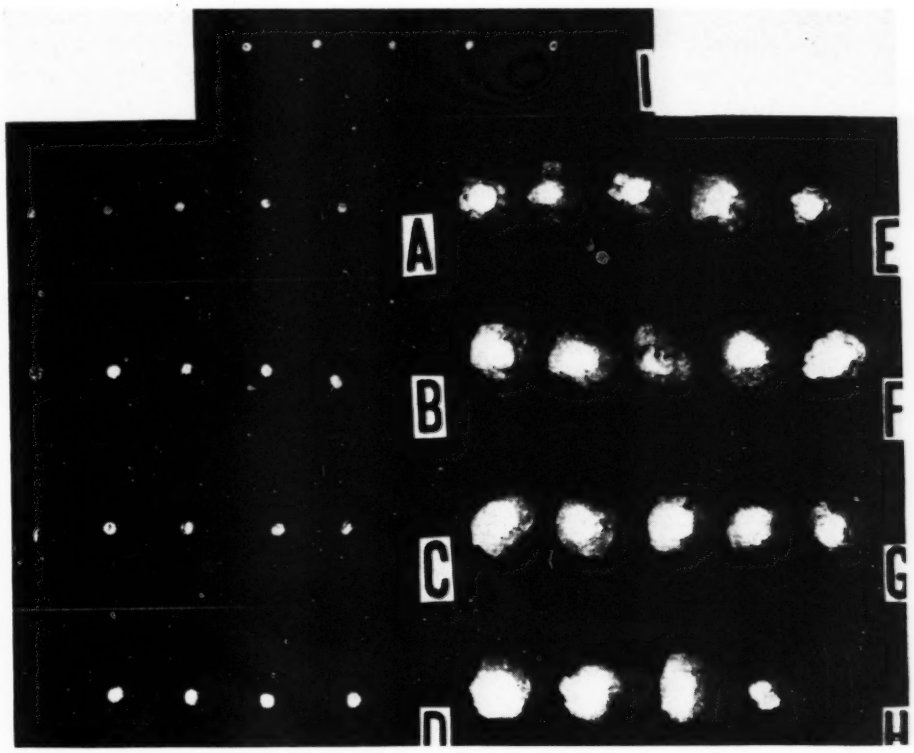


Fig. 2. Relative effects of indoleacetic acid and coconut milk on growth of carrot explants. I denotes initial size of explants; A to D, explants after growth on basal medium plus different concentrations of IAA; E to H, same with coconut milk added.

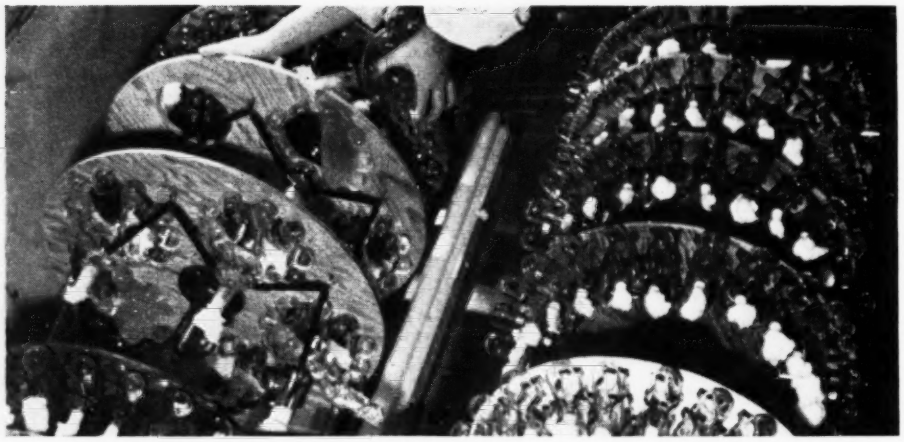


Fig. 3. Apparatus for the controlled growth of carrot tissue in liquid medium containing coconut milk. Lower wheels with culture tubes rotated 1 RPM; upper wheels with flasks for free cell cultures.

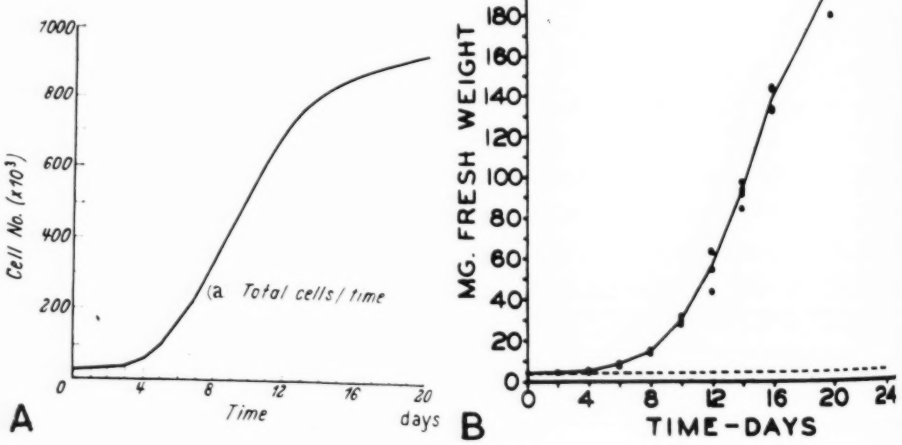
embryo of the coconut plant. Thus the liquid that normally nourishes an immature embryo contains materials that can restore to otherwise mature cells the rates of cell division that are characteristic of embryonic tissue. Full understanding of these stimuli should, therefore, contribute greatly to our understanding of the factors that induce growth by cell division.

It was first established that the materials responsible for this effect were not solely the then known auxin, that is, indoleacetic acid (Fig. 2). To study these effects, however, a technique had to be devised to permit quantitative data to be obtained (Fig. 3). Using such a technique for aseptic growth of standard explants[1] of carrot tissue in media with or without coconut milk, one can record the activity of the growth substances by the weight of the tissue. However, to distinguish between growth by cell division and growth by cell enlargement, precise data on the number of cells are needed, and for this a technique for macerating and counting the cells in a given piece of tissue must be employed. From the weight of the tissue and the number of the cells, their average weight, or volume, can be calculated. In following this procedure, it was found that a piece of initial carrot tissue, weighing between two and three milligrams may grow in the presence of coconut milk to between two hundred and fifty to three hundred milligrams in twenty to twenty-one days, and in so doing, the twenty-five to twenty-eight thousand initial cells may have increased to between two and three million (Fig. 4). There is here, then, a very dramatic stimulus to growth by cell multiplication.

However, the full potentiality of the growth induction by coconut milk is not to be observed only by the growth of the unorganized tissue cultures that result from the stimulation of growth in isolated carrot explants. Again by a special technique that emerged during the course of this work, one can obtain from the growing tissue cultures of carrot freely suspended carrot cells which grow and divide in the liquid medium. Incidentally, this has also been done for cells of the potato tuber and peanut cotyledon. However, it is remarkable that the freely suspended cells multiply in ways that would not be readily recognized from their behavior in the intact plant body; and, moreover, their growth can be continued until they form clumps of cells and until differentiation begins within the clump. Although the carrot explant rarely, if ever, forms roots, the isolated pieces of tissue grown from cells do form roots very readily and, if transferred to a semi-solid medium, they will also initiate shoots and eventually produce whole plants. Even the completely differentiated living cells of explants from the carrot root still retain the full potentiality to produce the whole plant body. Indeed, the long awaited ability to rear whole flowering plants from single cells seems now to have been achieved (Fig. 5). However, when the events are traced in detail, it is seen that en route to the whole plant minute pro-embryo-like structures are formed, so that the coconut milk, or nutrient medium for the immature embryo, has super-imposed on the otherwise vegetative cells of the carrot much of the behavior that is normally associated with the embryo itself. This raises the question how much of the behavior of the egg in the ovule is due to its special *nurture* in this curious "nursing-organ."

It is not to be expected that these responses are confined to carrot cells on the one hand and coconut milk on the other. Other sources of the effect here associated with coconut milk have been found in the immature grains of corn, that is, corn in the milk stage; the most useful source in a broad-leaved plant has been the immature fruits of the

Fig. 4. Curves showing time course of growth of explanted carrot root tissue. A, growth in terms of thousands of cells per explant. B, growth in terms of mgms. weight per explant.



1. Tissue taken from a plant and grown in a culture medium for the purpose of study.

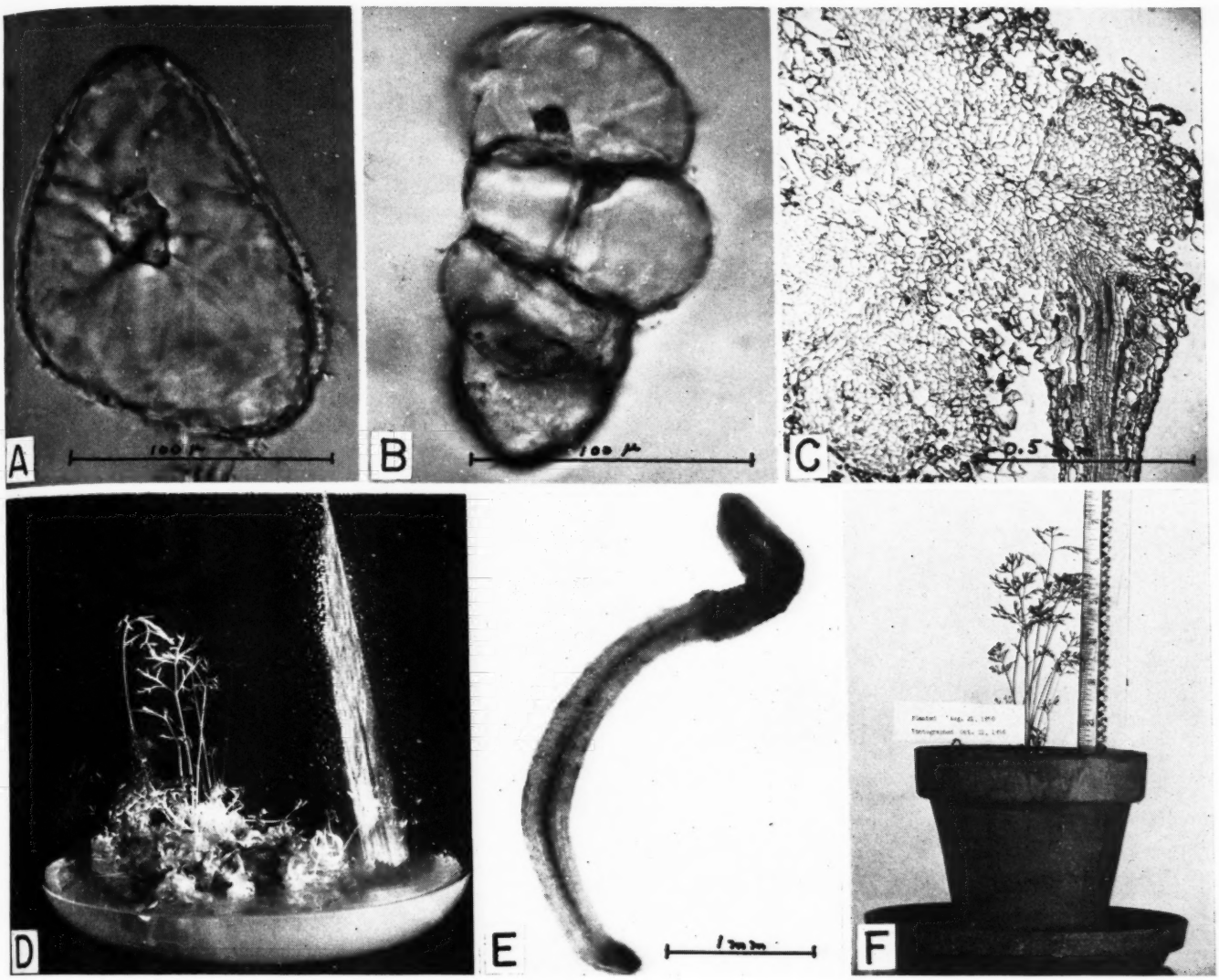


Fig. 5. Course of development from free cells to whole carrot plants: A = freely suspended carrot cell in liquid medium. B = similar cell after divisions in two planes at right angles. C = proliferated mass of cells showing a root emerging from a "nodule" or "center of growth" formed in the mass. D = young shoot emerging from the mass of cells grown on agar after transfer from liquid medium inoculated with free cells. E = young plantlet — teased out from D — showing embryo-like form. F = carrot plant which originated in the manner shown in A to E.

horse-chestnut. Although these different materials produce equivalent effects, they seem to do so by chemical substances that are not exactly identical. Even during normal development, certain stimuli of the kind here in question sometimes result in spontaneous cell division. Some plants by-pass the normal sexual process, because individual cells give rise to embryos without fertilization—the phenomenon commonly known as apomixis. In some plants, the stimuli to the development of fleshy fruits, which is often associated with the presence of an embryo, may occur even in non-seeded plants—this is the case in the edible banana. Often, also, plants spontaneously form tumors—this is true of certain hybrids of the tobacco plant. All these situations probably have something in common. It is known that an extract of the region that normally produces the fleshy edible portion of the banana will also make carrot cells grow; and it has been found that the strains of tobacco that form tumors spontaneously contain an excess of the cell division-promoting substances or stimuli. Plant tumors induced by the crown gall organism are also found to be rich in materials that will stimulate the growth of the carrot cells in the manner described. Thus the normal growth of cells by division may generally be controlled by a delicate chemical balance of growth promoters on the one hand and growth inhibitors on the other. Many chemical substances are now known which can act as inhibitors of the coconut milk growth stimulus, and indeed many organs which cease their growth by cell division, for example such storage organs as the potato tuber, yield evidence of these anti-growth substances for which the carrot-coconut milk system provides an assay system. The buds of trees pass through a period of activity when they are initially formed, then enter upon a period of rest and dormancy from which they eventually emerge; the control of this activity seems to lie in a similar type of mechanism. Some time ago (and here in Rochester) extracts were made from buds of maple in the late summer and early fall, and it was found that these extracts could suppress the growth of carrot explants in a medium containing coconut milk. This effect persisted until, after due exposure to cold, the buds emerged from their rest period, when

this growth inhibitory effect disappeared. The control of the machinery of rest and dormancy has, therefore, a somewhat similar basis in the control of growth by cell division or its suppression by appropriate inhibitors. When a tumor forms in plants, as in animals, unregulated cell division obtains; and one can readily see the parallel between the random, runaway growth that is caused by the effect of the coconut milk on the carrot explants and the inception of growth that may result in a cancerous type of tissue.

For all these reasons, great interest attaches to the chemical nature of the substances present in coconut milk, in corn extract, and in *Aesculus* (horse-chestnut) extract, that give rise to the effects here in question. It would take too long to describe the work of many years in which several investigators have been concerned. Briefly, the present position is as follows.

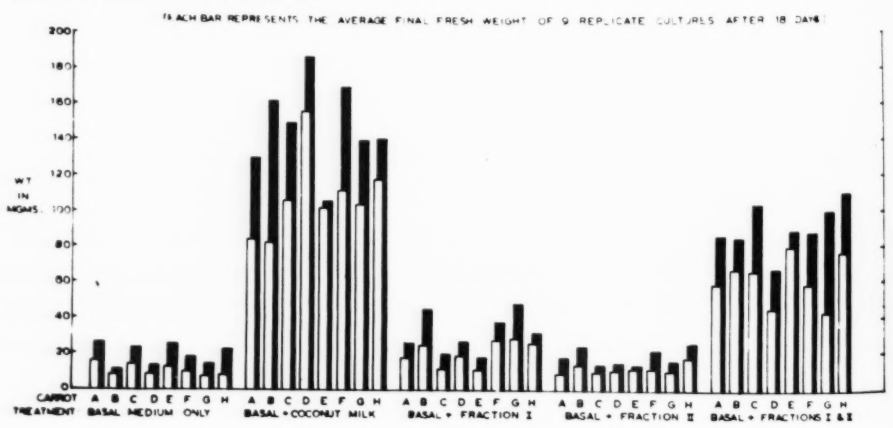
No single substance unlocks the door of cell division. There are obviously many substances that achieve these ends by different routes. Moreover, they appear not to act in isolation but to form part of a complex growth-promoting system. In the coconut milk, large amounts of which have been fractionated, there are at least three main portions to be considered. The first is a relatively non-specific source of organic nitrogen, for the cells use reduced nitrogen more readily than nitrate. For this portion of the coconut milk effect, casein hydrolysate can be substituted or a variety of known amino acids or nitrogen compounds. The more specific part of the coconut milk effect, however, is now known to be divisible into two broad fractions. One of these contains mostly substances that are chemically neutral, and for this reason is called the "neutral" fraction. While sugars are present in this fraction, the effect in question is over and above the nutritive effect of the sugars. By the work of Drs. Pollard and Shantz, it is now known that this fraction owes its main effect to sugar alcohols and cyclic hexitols, known as inositols. Three such substances have been isolated in crystalline form and critically identified. One of these is the sugar alcohol sorbitol, which is a main constituent of coconut milk; and two inositols known as *myo*-inositol and *scyllo*-inositol have been obtained. These substances do not themselves incite cell division, but unless they are present in the medium in the appropriate quantity, the cell division-promoting substances proper cannot act (Fig. 6). These growth-promoting substances that act specifically upon cell division do so at very great dilution, of the order of a few parts per million in the medium; and these together comprise what is now called the "active" fraction. It is abundantly clear that there are many such substances even in the active fraction. Some time ago, in work started at Rochester, three such substances, termed Compounds A, B, and C, were isolated and purified, and the identity of two of these seems to be clear. One is the substance diphenylurea, and the other may be xanthine. However, we now know that the first methods used to obtain these cell division-promoting substances suffered, because we were not then aware of the synergistic interaction with the so-called "neutral" fraction; and we know quite definitely that there are other substances in the coconut milk than those originally termed Compounds A, B, and C that promote cell division. Profiting by all this, a large isolation is now in progress in the tropics, using some two to three thousand gallons of coconut milk, and the expectation is that from this isolation the final answers will emerge.

However, from the analysis of large amounts of corn extract, quite different cell division-promoting substances have been obtained; amongst these is a new indoleacetic-acid-arabinose complex, the full structure of which is not yet known. From the *Aesculus* extract, purified leucoanthocyanins have been obtained, which similarly promote growth by cell division and this class of substance seems to be present in all the endosperms examined, particularly in the more solid portions of the endosperm or in the integument which often nourishes the growing embryo. Some four crystalline substances were isolated from the *Aesculus* fruit, particularly from the liquid portion of it, and one of these turns out to be either chlorogenic acid or a substance very closely related to it. Therefore, there is no simple common denominator between the various substances that have been found to stimulate growth by cell division, and this at present is the status of this field work.

Consequently, the primary process of growth by cell division is not alone stimulated by nutrients, but over and above this are chemical regulatory effects which act first upon the process of cell multiplication. The over-all system that controls the ability of plant cells to utilize their nutrients and to canalize their effect into growth by cell division is complex. It involves many substances of diverse nature, which interact to produce the effect in question. The full identification of all the substances that participate in these effects is a prime task for the plant physiologist, and it underlies the interpretation of all growth and development. When it is known how these effects work in the normal nutrition of the growing point, it may be possible to understand how the effect of such stimuli as those of length of day and night temperature upon processes of growth and development are mediated; here also there must

(Continued on page 94)

Fig. 6. Growth response of 3 mgm. tissue explants from eight different carrot roots to whole coconut milk and to coconut milk fractions I (active fraction) and II (neutral fraction) separately and in combination, in basal medium (white bars) and in basal medium + 0.025% casein hydrolysate (solid bars).



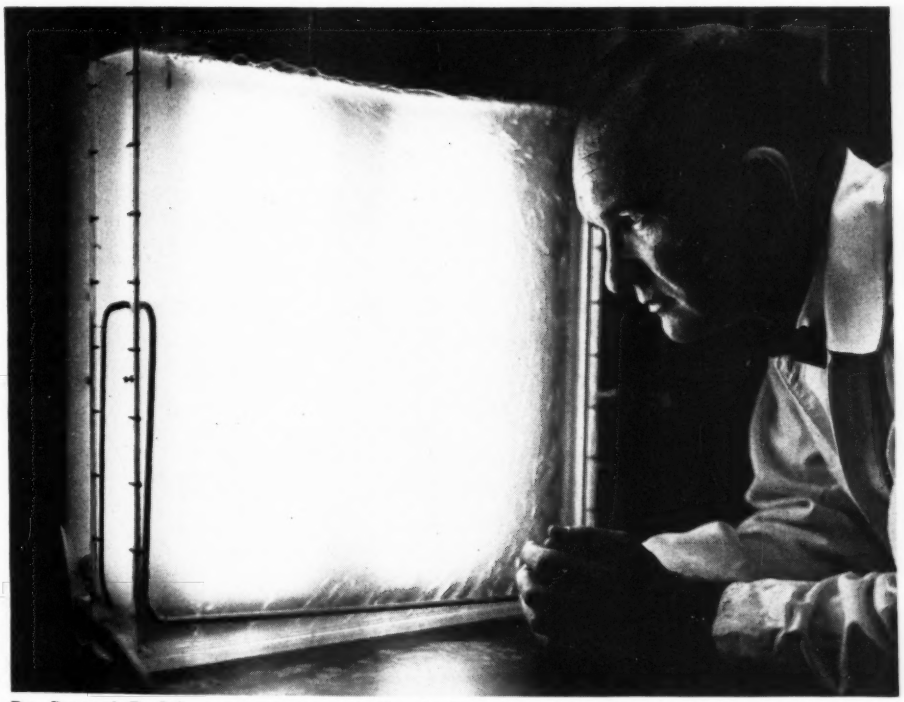
AN OUTER SPACE GARDEN

By Samuel J. Johnson

Boeing scientists, studying how a man may be kept alive in space, are faced with an immutable fact: a man must eat, he must have air to breathe whether he stays out of the atmosphere minutes or longer, and in space travel he must have these things within a vehicle small and light enough to be propelled out of the earth's atmosphere and gravity belt.

The answer sought by these scientists is a closed ecological system in which water, oxygen, and foodstuffs can complete the whole natural cycle in limited space and fairly fast time.

The author of the following article, Dr. Samuel P. Johnson, is Senior Plant Physiologist in the Space Medicine Section of the Aero-Space Division of Boeing Airplane Company, Seattle, Washington. Dr. Johnson was formerly associate professor of plant physiology of the Texas Agricultural and Mechanical College System at College Station, Texas.



Dr. Samuel P. Johnson inspects a tank of algae in one of the experimental units of the Biosciences Section of the Boeing Airplane Company. The density of the algae is quite low; otherwise, the light would not go through.

IN THE EARLY STAGES of space exploration, short-term space probes require only that the crew be fed from the condensed rations familiar to everyone who has served with the armed forces. Oxygen for breathing and drinking water will be supplied as needed from stores.

As the duration of the flight increases into months, a weight concession must be made — liquid human waste must be converted into potable water.

For flights beyond six months duration, the remaining human waste must be recovered and recombined into edible food and oxygen.

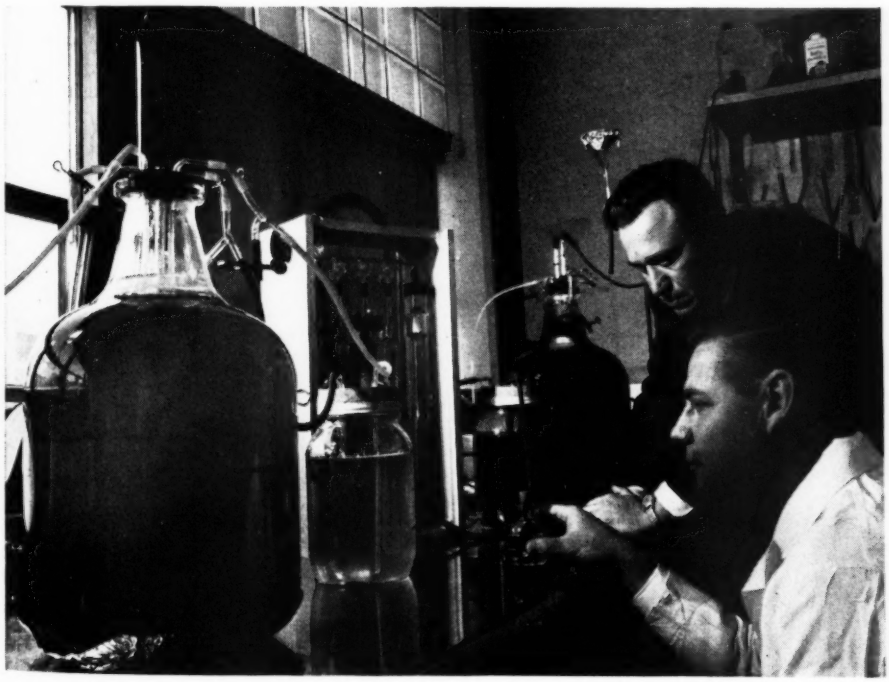
Since the processing of human waste into useful products by purely chemical means involves too great a weight penalty, the engineers of outer space turned to plants in their search for a solution to this problem. Photosynthesis, the plant process known to all of us, is about three times more efficient than the chemical plant of industry in converting human waste into edible food and oxygen.

The system, which is called a closed ecological system in space terminology, involves a plant or plants to furnish food and oxygen to the crew. The plant derives its nutrients, water, and carbon dioxide from a human waste converter system.

The plant selected to accompany the crew into space is the alga chlorella, a microscopic, single-celled plant that is relatively easy to grow in aerated liquid. Chlorella does not reproduce sexually but remains in the vegetative state.

The food production of chlorella is very high on a unit-volume basis. Although several hundred liters of alga suspension are required to furnish food and oxygen for one man at present, it is expected that as soon as alga culture attains the fine precision of modern

(Continued on page 114)



Dr. Joseph Stern, in back, Biochemistry Unit Chief in the Space Medicine Branch of Boeing's Systems Management Office, and Dr. Albert K. Sparks of the College of Fisheries, University of Washington, note progress in an experiment to grow the tropical fish, *Tilapia*, in small jar at center, on algae growing in large jar at left. Algae grow on carbon dioxide and human waste, thus providing a possible answer to waste-disposal problem in space travel.

BIRD TAMING IN MONTANA

The Story of "Trouble" and "Greedy"

By **Herman F. Becker**

Dr. Becker is Visiting Research Associate at The New York Botanical Garden.

ONE OF MY rarely admitted passions, fed by nostalgic memories of childhood and since confined to a latent, but constantly glowing desire, is to gain the confidence of birds, wild and free. Suddenly, during the summer of 1959, these haunting, permanently recurring memories burst into reality during my season's stay in the upper Ruby River basin in southwestern Montana. Though I had not tried my hand at taming birds for the past forty years, I knew that I would succeed by employing the same time-proven methods that worked so well in the rolling, Pennsylvania-like region of the Saar Valley. There I was rarely without a pet blue jay, crow, or jackdaw. These birds, raised from infancy, remained with me — some for years—as constant companions through woods and field.

In my capacity as palaeobotanist I have had the opportunity during many field seasons to collect plant and insect fossils in the Ruby area, a rugged and mountainous terrain with sprawling benches that gradually descend to the river. The region is sparsely inhabited, vegetation and climate are semi-desert; an ideal place for magpies, falcons, hawks, and owls. Mice, packrats, chipmunks, rabbits, and rattlesnakes provide abundant food for many of these birds.

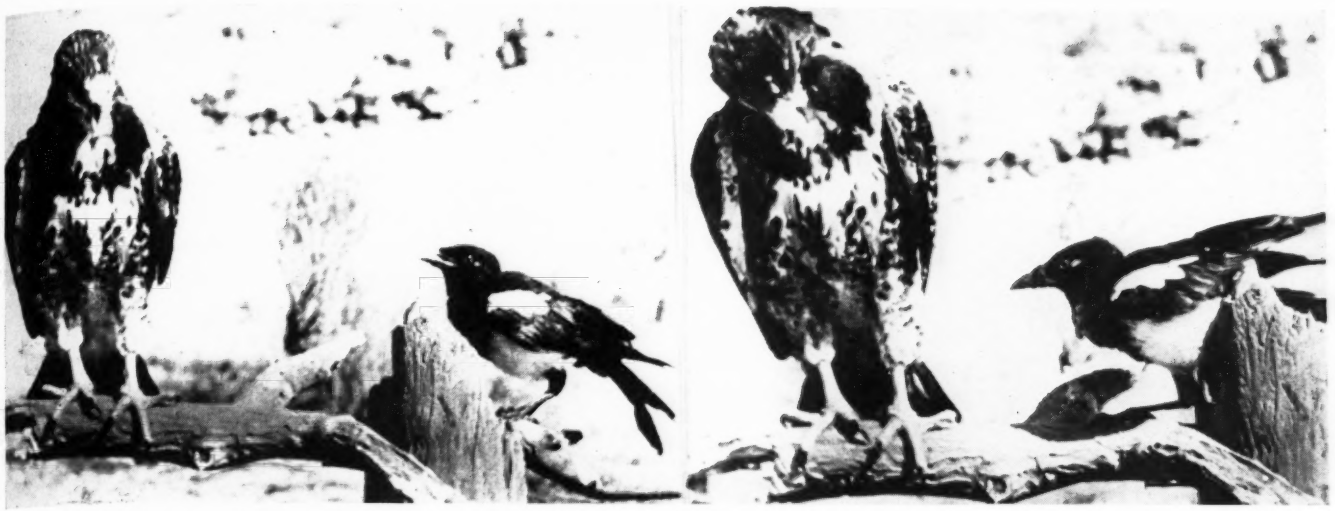
A previous, fortuitous experience with an adult horned owl that I found unconscious on the road and nursed back to life, taught me to be completely unafraid (if cautious) even of birds of prey. I now take it for granted that this feeling is mutual, if constant protection and proper and ample food are provided. For two weeks the owl remained at the camp site on a perch in a hollow tree, demanded food, and simply refused to leave. In order to get rid of it, I had to drive some miles away from camp and shoo it into the night.

In the cottonwoods along the Ruby River and in the barren drywashes of the benches, there are hundreds of noisy magpies and a score of red-tailed hawks. One day late in June my attention was drawn to noises and activity in a dense juniper tree near our fossil outcrops. To my surprise I found a lone, half-naked, half-starved, and maggot-infested magpie, about ten days old. The young bird was taken from the huge and obviously deserted nest, brought to the camp, and placed in an open, sage-and-cotton-lined box. After several maggots had been removed from the ear openings, the orphan was given bread soaked in water, hard-boiled egg, and bits of chopped meat. Although force-feeding was necessary for two days, the young bird, later called "Trouble," demanded food from the third day on with loud and screeching noises every time someone approached. Trouble grew rapidly and soon began hopping around the camp site, pecking at pebbles, sticks, and ants, tearing the labels from tin cans, falling into the dish water, and jumping into a plate of hot soup. His mischievous curiosity got him into the most ridiculous situations and demanded "controlled" patience, a sort of "grin and bear it." His rapidly developing plumage of white and shiny blue-black and his extremely long, bobbing tail soon turned him into a formidable fledgeling. Disregarding all sanitary rules, Trouble now flew from one head to another, insisted upon sitting on and pecking at our hands or tools, toothpaste or shaving cream, or taking a bath in the cooking pot. Thus Trouble helped us with our work; and when he was out of sight there was no doubt where he had been, for he was generous with his calling cards. He began to accompany us on our daily forays, but

Dr. Herman F. Becker holds the young hawk, with down-covered, drooping wings, the day it was taken from the nest.

One month of loving care transforms the nestling into an alert, if shaggy pet.

Innocent "Trouble" eyes the suspicious hawk for possible mischievous action.



"Calm before the storm." "Watch out, here I come!" Does the magpie know that the hawk cannot yet balance on one foot and thus is unable to use its talons for defense?

never strayed far away from us and food. By then he had learned to relish grasshoppers, beetles, ants, butterflies, and raw meat, as well as almost any kind of canned food including sardines, soft drinks, coffee, and fruit. His favorite pastime, however, was to sneak into the roomy tent to cause general havoc. Stamps, letters, tissues, coins, razor blades, rattlesnake rattles, and countless other items were stolen, ripped to shreds, tucked into the folds of blankets. Not a square foot was spared his indiscriminate wreckage. When I was working and reading in the tent at night—I had finally taught him not to use my head as a nest—he reluctantly perched on my shoulder and fell asleep. Trouble's ability to learn seemed remarkable. Only once did he dip his beak into hot coffee, and on another occasion peck at embers in the fireplace, never again!

After six weeks, keen-eyed and almost fully grown, the hawk approaches the plumage pattern of its parents. Now its wingspan is three feet.

When Trouble was about three weeks old, I discovered the nest of a red-tailed hawk in a tall, dense willow thicket near Mormon Creek. The parents were lazily soaring in graceful circles, high against the blue morning sky. The thought came to me suddenly —and was too much challenge to be passed up. Soon I was swaying twenty feet off the ground, faced with a huge nest built of interwoven sticks and branches. Three young hawks were momentarily standing on their feet, staring intently, and awkwardly flapping their enormous, narrow wings. Somewhat uneasy about the possible intervention of the nearby parents, I took the nearest bird, cradled it in my jacket, and cautiously descended. The little bird never showed any sign of defense or fear. An abandoned magpie nest, placed under the awning of the tent, served as its new home.

The young hawk, with a wingspan of fifteen inches, and not more than two weeks old, also had to be cleaned of maggots in the ear openings and around the neck, where blood from previous feedings had soaked and matted its soft, gray down. After the first force-feeding of hard-boiled egg, food was taken greedily everytime it was offered. Mice, chipmunks (skin and bones), rabbit meat, and beef were substituted for soaked bread and egg which he soon refused. "Greedy's" growth was commensurate with his phenomenal, insatiable appetite of, for example, an entire hindleg of rabbit at one sitting, or half of a three-foot rattlesnake, skinned and cut into two-inch pieces. The hawk never took water or any other liquid.

We learned from Greedy that hawks keep their nest clean from the earliest age. When the time arrives, and that is quite often, they creep to the edge of the nest, turn around, go through curious adjusting movements and forcefully eject — over the rim, sometimes three to four feet in a horizontal line.

The happy "Trio" just prior to their separation.

As Greedy grew, he wandered around the camp site very much like a chicken, pecking here and there. He would particularly respond to a high-pitched whistle through the teeth, or a cry similar to that of adult hawks when they are soaring. Greedy, just like Trouble, was completely tame, attached, and displayed obvious pleasure at having his head and back scratched. His dignity of movement and behaviour contrasted sharply with that of the "urchin," Trouble.

The relationship between these two was one of watchful distrust and obvious jealousy on the part of the magpie. Trouble would cautiously, and as though innocently, sneak up, then with lightning speed peck at Greedy's feet or jump on his back to belabor his head. At feeding time he tried to snatch every morsel that the hawk was about to devour. But one day, magpie feathers flew. Trouble had learned yet another lesson. He looked sad, indeed, without a tail.

In August, three days before my departure, the hawk made his first attempt to fly. I left him—in full plumage and with a three-foot wingspread—in the care of a game warden; I learned later that he departed in October for the nearby mountains. Trouble also joined a flock of his own at about the same time.

I do not advocate the taming of wild birds unless one possesses a thorough knowledge of their life and feeding habits, and unless a suitable environment, similar to their natural habitat, is provided. One should never attempt to confine such birds to a small enclosure, but allow complete freedom of movement; never hold them forcefully; never retaliate when they peck or scratch (even if it hurts), but make them realize that hands and fingers are "friends" that feed them instead of instruments of torture. And one should speak softly and avoid sudden motions. Greedy, with his enormous beak and talons, and Trouble, with his shrill noisiness or soft, imitating cooing, have given me unforgettable pleasure and companionship in a generally barren land. It is well-nigh impossible to put into words the feeling of elation that arises from being accepted as a trusted friend by birds of prey in their world of Nature, where Man is but the common enemy.

TRENDS IN BOTANY (from page 86)

phytotrons, after the pioneer developments of Frits Went. With these facilities that may duplicate all the climates of the world, experimental ecologists, taxonomists, morphologists, and physiologists can test the innate variability and nature of plant materials.

I predict that paleobotany, through the development of more refined techniques and the exploration of new and rich deposits, will reveal plant materials perfectly fascinating to morphologists, systematists, and geologists. The field of micropaleontology is in especial need of expansion by botanists.

Although exploited and unfortunately somewhat discredited more than forty years ago, the field of serum diagnosis, for determining the degree of relationship of organisms and groups of organisms, is entering a new phase, in which the results are more important than the justification of the techniques. Through varied biochemical and biophysical techniques, ranging from chromatography to electrophoresis, the proteins and sera of plants and animals are being studied and compared at an ever increasing rate. I predict positive and enlightening results from these techniques that can be almost immediately applied to the solution of some of our numerous and perplexing problems of plant phylogeny.

Although almost a stepchild of botany a generation ago, ecology has come of age and is now a welcome and important member of the family. Among the most significant contributions of ecology, in my estimation, was Chaney's application of the philosophy of associations to paleobotany, thereby clarifying the identification of many previously unknown members of several geological horizons. The detailed studies of plant associations in the Brazilian rain-forest by Cain and his co-workers in *Fifty Years of Botany*, will long remain a classic of its kind.

I foresee that many relatively or totally new phenomena will receive study by botanists. Carbon-14 is a magnificent indicator of the past, and through its determination, accurate estimates can be made of plant migrations and post-Pleistocene plant history. The ecological and phytogeographic significance of this technique has hardly been touched.

Permafrost, or permanently frozen ground, is a little known, little recognized phenomenon of arctic regions, little studied by botanists, yet has a pervasive influence on the distribution of plants and animals. I predict a much greater emphasis in botanical research on the implications of permafrost, especially in view of our uneasy but inevitable preoccupation with northern regions.

One of the bright spots in the future of the various areas of systematic botany, plant morphology, phytogeography, ecology, paleobotany, is the valiant effort of the National Science Foundation to support basic research. While plant physiology, biochemistry, and genetics derive support from a dozen or more private and governmental agencies, the so-called "descriptive" areas remain without adequate support, illustrating too well the fact that even within the boundaries of science one may find "have" and "have-not" fields. The prospect of ever increasing financial support for research of a basic nature in our "have-not" areas is encouraging, indeed.

I conclude that the future of botany is very bright. If you think I say this in any offhand or casual manner, I must remind you that I have recently dedicated the remainder of my professional life to what I consider to be the best interests of botany, and with the intention of devoting my full energies to the field. Only history will supply a brief footnote on the wisdom of my decision!

CARROTS AND COCONUTS (from page 90)

be a chemical link between the effect of the environment on the one hand and the growth on the other. As in dormancy, the chemical trigger may operate through the control of cell division and cell enlargement, utilizing a system similar to that which can be detected through the interacting effects of "carrots and coconuts."

WEEDING LAWNS

By **Robert W. Schery**

Dr. Schery is Director of The Lawn Institute, Marysville, Ohio.

PLANTS HAVE EVOLVED which will grow on almost any soil, short of those that are chemically poisoned or absolutely without water. Consequently, there will always be weeds; that is, there will always be unwanted plants cropping up, if wanted plants do not already fill the space. Of course, any plants you do not want growing in the lawn are weeds there. These "weeds" may even be planted grasses (but those that you do not favor), or a legume such as clover, a component of some lawn seed mixtures.

The point, however, is not to define what a weed is, but to illustrate that weeding is a part of the whole lawn-maintenance program. Any time that turf-grass fails, for whatever cause, weeds are sure to be a problem. And any time you clean out the weeds, by whatever method, the respite will be temporary unless you are able to correct the conditions that kept the grass from growing well in the first place. Thus, paradoxical as it may seem, the first step in weed control might not be digging the dastards out or applying potent weed-killers, but sowing the proper seed or fertilizing grass at the right season.

Spot treatment for selective removal of dandelions being carried out with a 2,4-D type chemical.

For the northern two-thirds of the nation, the best lawn guardians are the bluegrasses and red fescue varieties, since they flourish in many situations. Fertilizing these grasses generously in autumn, the season in which they build reserves for a good start the following year (and the season when most lawn weeds retire, too) is a big step towards crowding out spring weeds before they even begin. A second big step is setting the mower high (as high as three inches in southern portions of the bluegrass belt; one and one half inches may be sufficient in the North). High mowing strengthens the grass and enables it to shade and crowd weeds.

The third step is emergency treatment, to eliminate weeds that have gained a foothold. It is sometimes possible (on established turf) to "immunize" the soil chemically against the sprouting of annual weed seeds, crabgrass especially. The treatments seldom last for more than a season; but if weeds are prevented even one year, less seed is set for future years. The soil will seldom be completely free from weed seeds; seeds of crabgrass and other species may lie dormant for years, only to sprout when churned to the surface by winter frosts, or when the established turf is accidentally scuffed thin. Harmful weeds are almost never introduced into the lawn from reliable brands of seed mixtures, assiduously checked as they are.

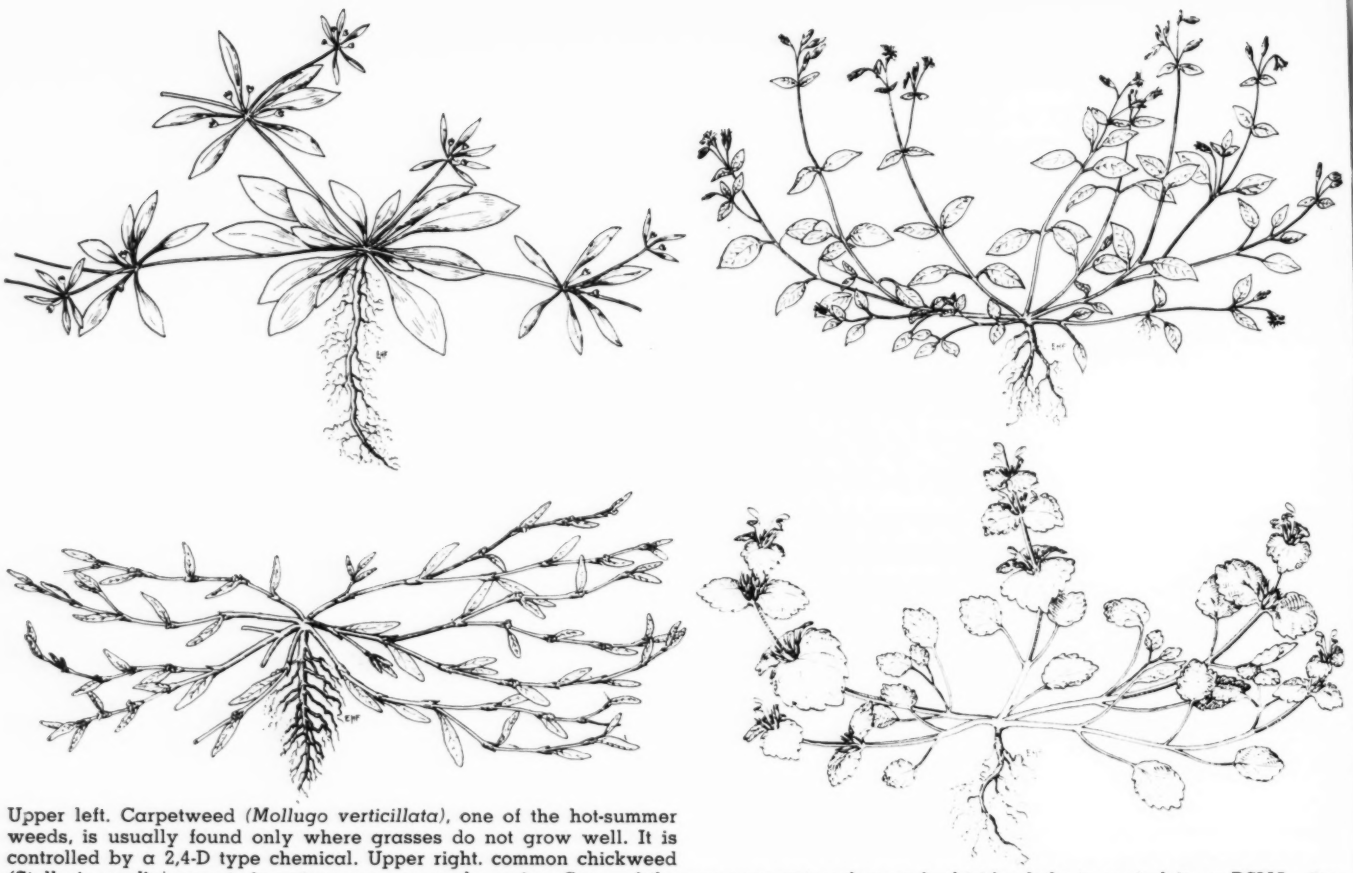
This is one of the inexpensive automatic sprays for weed control; it can be used in controlling crabgrass.

Chemical weed treatment has become a complicated science in itself. Each year numerous papers are presented at conventions, reams of articles are written, and hosts of new chemical combinations are offered for experimentation. But instead of speculating on the future, let us look at the chemicals widely marketed for weed control today. There are two main categories: (1) the 2,4-D family of herbicides, primarily used for elimination of broad-leaved weeds or dicotyledons (dandelions, plantains, chickweeds, spurge, and so on); and (2) the mixed assortment of chemicals primarily used for selective elimination of annual grasses in established turf (crabgrass especially, but also foxtail, goosegrass, and even some of the annual dicots such as chickweed).

BROADLEAF WEED KILLERS. About the time of World War II, 2,4-D (2,4 dichlorophenoxyacetic acid) was developed at Boyce Thompson Institute for Plant Research. This was an outgrowth of study on growth-regulating compounds; it was discovered that at certain concentrations this particular compound almost miraculously causes certain species to die while it does not affect others. Grasses are especially immune. Consequently, use of 2,4-D as a lawn-weeding chemical was almost inevitable.

Since the first 2,4-D acid was marketed, chemists have introduced a long series of salts, esters, and amine formulations, so that there are today less volatile forms, not quite so hazardous around the home, and forms for more specific employment. Changes in the molecule have yielded 2,4,5-T and 2,4,5-TP (silvex). These kill certain additional species that were resistant to 2,4-D itself. Most general weed-control

This automatic spray appratus is being used for general weed control in the summer on bluegrass in Ohio.



Upper left. Carpetweed *(Mollugo verticillata)*, one of the hot-summer weeds, is usually found only where grasses do not grow well. It is controlled by a 2,4-D type chemical. Upper right. common chickweed *(Stellaria media)* sprouts in autumn or very early spring. Some of the pre-emergent crabgrass herbicides help to control it; or DSMA, silvex, neburon, and so on, can be applied early in the spring. Lower left. Knotweed *(Polygonum aviculare)* is especially frequent on compacted soil where grass grows poorly. This trailing culprit is hard to kill, but succumbs to a 2,4-D type chemical early in the season. Lower right. Henbit *(Lamium amplexicaule)* is a little difficult to eradicate, partly because it thrives in cool weather when herbicides are less effective. Repeated applications of silvex or 2,4-D should do the job.

chemicals are based upon the 2,4-D-type chemicals, singly or in mixture (a silvex—2,4-D mixture is being widely marketed this year). Used carefully and according to directions, these remove drudgery from weeding.

Almost invariably such herbicides are most effective when weeds are growing vigorously, as in warm weather after rain. They are more lethal to younger weeds than to older (spurge, *Euphorbia*, and knotweed, *Polygonum aviculare*, are especially resistant when mature). The familiar northern lawn grasses, especially bluegrass, *Poa pratensis*, and the lawn fescues, *Festuca rubra* in variety, are quite tolerant of 2,4-D weed sprays. Caution is advised in exceptionally hot weather, and when the compound is mixed with fertilizer or other materials. But if directions are followed carefully, 2,4-D nowadays makes merry of what was a formidable task.

ANNUAL GRASS HERBICIDES. The attack on annual grasses, crabgrass especially, has yielded such a variety of useful chemicals that it is hard to generalize. Basically there are two chemical approaches to crabgrass elimination: (1) soil treatment, to kill seedlings as the seeds sprout (pre-emergence treatment), and (2) application to growing weeds (post-emergence). Pre-emergence treatment is the more recent development, and the technique is being heavily promoted this year. It is likely to be somewhat more expensive than post-emergence control. Pre-emergence treatment must be made before weed seeds sprout, preferably in early spring, or even in the preceding autumn. The lawn is blanketed with the chemical, which acts through the soil on sprouting seed but does not harm the older, established grass. Carefully applied, the treatment is at least ninety per cent effective.

FOR SPROUTING WEEDS. Four pre-emergence chemicals have achieved widespread recognition for crabgrass control; to a greater or lesser extent they inhibit any sprouting seed. Long used for grub-proofing, arsenic compounds (lead arsenate, calcium arsenate, or arsenical mixtures) have been shown to inhibit crabgrass at rates of from fifteen to twenty-five pounds to the thousand square feet. A familiar insecticide, turned herbicide at heavier dosages, is chlordane (recommended at one and a half pounds of active ingredient per thousand square feet). Two very effective newer compounds are zytron (Dow Chemical) and dacthal (Diamond Alkali), both of which are effective at rates even lighter than those recommended for chlordane.

These chemicals show up as active ingredients in an array of brand products, each of which is formulated to the manufacturer's liking; since formulations differ, it is imperative to follow application directions on the package exactly. Dry granular products or liquid sprays seem to be about equally effective. The effectiveness lasts from a few weeks up to an entire year, depending upon chemical, soil and weather. In the following years a booster application with some, or a repeat treatment, may be advisable (see directions on package).

FOR GROWING WEEDS. Chemical substances for killing growing crabgrass have had many more years of trial than have the pre-emergents. Arsenites were first recommended, but proved poorly selective, burning the grass as well as the weeds. Potassium cyanate was an improvement, but still tended to burn the turf when used at high enough concentrations. The phenyl mercuries were somewhat more selective than potassium cyanate, but needed three or four repeat applications, and in some areas did not work well.

Leading the parade today are the methyl arsonates (DSMA, AMA) which give satisfactory control in two applications about a week apart; both dry and spray formulations are available. The treatment is, on the whole, more economical than pre-emergence treatment. Early summer would be the logical time to go after crabgrass, before this weed starts setting seed heads. If there is doubt whether a weed is crabgrass, a specimen can be sent for identification to a nearby botanical garden or experiment station, or to a commercial concern that deals in lawn products. The arsonates will not bother coarse perennial grasses, which some home owners mistake for crabgrass.

Arsonates have also killed some broad-leaved weeds resistant to 2,4-D (mouse-ear chickweed, for example); such pests as dallisgrass in the upper South; and annual companions of crabgrass, such as goosegrass and foxtail. As a matter of fact, arsonate mixed with 2,4-D is a pretty lethal weed-killer for practically anything that crops up in the lawn. But do be careful with any herbicide; uniform application at rates recommended for the product is essential, since a little too much can set back the grass.

Cress (*Lepidium campestre*) sprouts in new lawns in autumn, but can be easily eliminated on a warm day in autumn or in spring by 2,4-D.

RESISTANT WEEDS. The researchers have not yet found anything that is very good for many of the perennial grass weeds. These are so like the desired grasses that killing them is almost certain to kill the lawn grasses, too. Zytron is reported sometimes to kill nimblewill (*Muhlenbergia schreberi*) selectively in bluegrass, as will presumably a just-so application of maleic hydrazide. But there is need for more experimentation before these can be confidently recommended for general usage.

There are several useful non-selective chemicals, that is, compounds which kill back all vegetation. These may be the only recourse for especially pernicious and deep-rooting grass weeds, such as quackgrass. Dalapon is most frequently employed against weed grasses; amino triazole might serve in some situations. It is also possible to spot-treat with gasoline or kerosene, simazin, TCA, sodium arsenite, and so forth. With all non-selective treatments it is necessary to rework and reseed devastated spots.

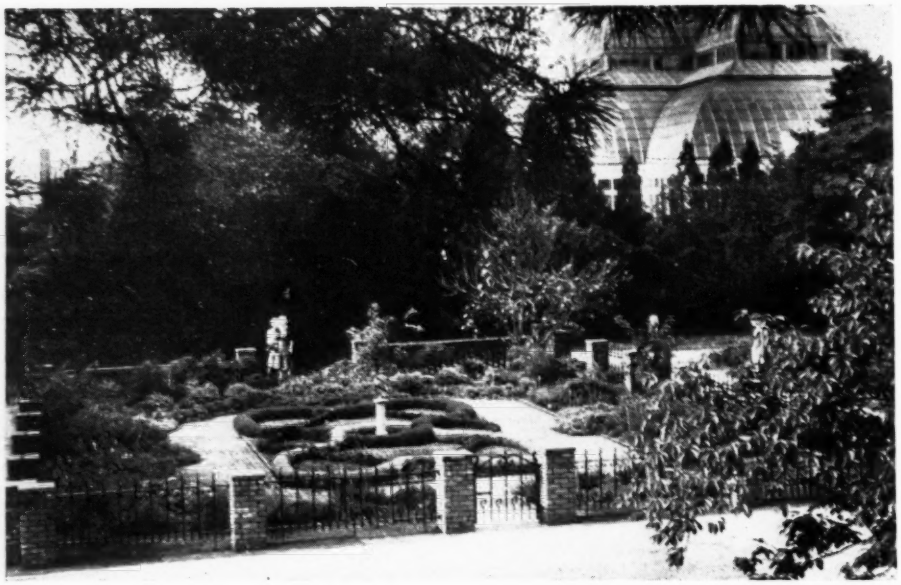
For large seed beds soil sterilants can be helpful (such as methyl bromide, "Vapam," "Mylone"). Properly employed a few weeks before lawn seeding, they not only kill all vegetation but presumably insects and disease organisms as well. Soil sterilization is an operation for professionals rather than for home owners, since precise application and adequate equipment are important. And, of course, there is always the danger of injury to shrubs or trees which have roots running into the soil being treated.

OTHER METHODS. The plethora of chemicals already mentioned is certainly confusing. I shall not complicate matters further by discussing specialty items, in which a compound with limitations for general use might be especially effective against a given weed (neburon for chickweed, or endothal for certain speedwells). But another weed-control method remains, that is, mechanical instead of chemical removal. At one time this was laboriously accomplished by hand-pulling or digging. More recently special blades or attachments have been devised for mowers and thinning machines; these tear up trailing weeds, such as crabgrass, with little or no injury to the upright grasses (bluegrass and fescue), although stoloniferous bentgrass and Bermuda would be severely thinned. Some manufacturers supply an interchangeable blade for rotary mowers, which tears out crabgrass.

Perhaps we should even mention the old southern custom of smothering weeds and grass alike by laying roofing paper over the lawn. A modern version of keeping light and air from growing plants might be contrived with opaque polyethylene plastic sheets; these could be tacked onto the lawn by inserting long, large-headed nails through the edges of the sheets.

It is evident that there are innumerable ways of attacking lawn weeds, but elimination of the weeds is only the first step. Unless a good sod of bluegrass and fescue in the North, of Bermuda, zoysia, centipede, or St. Augustine in the South takes over afterwards, the problem will recur endlessly. The most important feature of weed control is planting quality grasses and managing them properly.

Buckthorn plantain (*Plantago lanceolata*), the ubiquitous example of broad-leaved weeds which spring up in almost all lawns, is easily controlled with 2,4-D.



THE HERB GARDEN

By Olive Willett Smith

Olive Willett (Mrs. Harry Brokaw) Smith, author and lecturer, established her own St. Fiacre herb garden more than thirty years ago and dedicated it to this saint of gardens and gardeners. She is First Vice-President of the Herb Society of America. A former chairman of the New York Unit of this Society, Mrs. Smith is at present the Unit's garden and planting chairman.

The Herb Garden at The New York Botanical Garden has been redesigned and replanted under the direction of the Garden Committee of the New York Unit of the Herb Society of America. The garden for the study of herb collections, at the right of the formal garden, is not visible in this picture.

EVERY YEAR many thousands of people visit the Herb Garden of The New York Botanical Garden. Why do they? What is the fascination which draws them to this spot? Perhaps the answer may be found in their subconscious background, for the love of herbs reaches back to ancient times when herbs were man's food and medicine and provided the magic symbolism in his religious rites.

Among the first gardens established for the study of plants were herb gardens. As the scientific study of plants advanced slowly through the centuries, a system of classification emerged; and botanical gardens, as we know them today, were gradually developed with their systematic and ornamental plantings, their herbariums and libraries. A number of them retained plots for the study of herbs.

The beginning of the Herb Garden at The New York Botanical Garden goes back well over a decade, when a committee from the New York Unit of the Herb Society of America formally suggested the creation of such a garden. The Garden administration was most receptive to the offer, and plans were immediately made for its development. The Unit provided drawings and supervised the planting of the garden which was established on a plot, fifty-six by forty-two feet, slightly to the northeast of the Conservatory. A pleasing design of color and form was attained; many of the plants were given by members of the Unit. The Herb Garden soon proved to be a greatly appreciated addition to The New York Botanical Garden and a source of information to the gardening public.

The desire to enhance the educational aspect of the Herb Garden and the necessity to reduce its maintenance have brought changes to the earlier garden. The present arrangement includes two gardens—a formal garden and a garden for the study of herb collections.

The formal garden occupies the original site. In the center is a knot garden, an interlacing of design, patterned after great garden traditions. The thrids* outlining the closed pattern are formed of gray santolina (*Santolina chamaecyparissus*), green santolina (*S. virens*), and dwarf box (*Buxus sempervirens suffruticosa*). The knot is surrounded by walks of permanent weathered brick in basket design. The garden design is completed by planted borders arranged for a dramatic display of color and for a foil to the green and gray foliage of the herbs. Architectural effects are achieved by careful selection of the plants so that a stepped-down aspect is obtained of pleasing variations in height. Individual plants are clearly labeled with the common and scientific names, and often with information of historical interest.

A sundial, an armillary sphere mounted on a pedestal, is an important feature in the garden. It was presented to the garden by the New York Unit in memory of the late Helen Noyes Webster, a former president of the Herb Society of America, and it bears the inscription

"Yet a little while is the light with you
Walk while you have the light"

Inside the gate are sand-colored pottery jars that stood for many years in the earlier garden. These jars were a gift from Helen M. Fox. They contain specimens of myrtle (*Myrtus communis nana*).

An old wrought-iron fence encloses the Herb Garden. The design is that of a flame and a shepherd's crook. Brick columns and panels of open brickwork support the fence and complement it. They form an integral part of the area and are appropriate to the location and to the architectural background of the Botanical Garden. The fence, a gift from Harry Brokaw Smith, was installed by the Unit.

Adjacent to the formal Herb Garden is the garden for the study of herb collections. Here herbs are grown for observation and comparison. Beds are devoted to selected genera, and many kinds of each genera are grown in close proximity to each other. Paths make the beds accessible for close inspection. An interesting old bench, another gift from Mrs. Fox, is well located where the student may pause to arrange his notes or indulge in study while surrounded by herb specimens.

These recent gardens have been designed and established by the Garden

*corruption of the word thread; used in connection with a knot garden means narrow lines weaving or curving through other lines.

Damask rose, *Rosa damascena.*

Committee of the New York Unit with the assistance of the very able Horticulturist, Louis P. Politi.

The gardens offer a wide variety of interests. There are herbs that came into use in empirical medicine; their history may be traced from the beginning of man's records to the modern drug lists in the *United States Pharmacopoeia* and the *United States Dispensatory*. Falling over the brick edging in the garden is the low, gray, round-leaved Dittany-of-Crete (*Origanum dictamnus*), a sacred healing herb. Others are the lovely silvery green *Artemisia absinthium*, which Moses prescribed for the children of Israel because of its therapeutic bitterness—for the ancient Hebrews used many herbs for culinary, medicinal, and olefactory purposes and in religious rites; horehound with its frosty leaf pattern that lingers in the garden long after frost and is helpful for coughs and colds; stately digitalis, with its thimble-like flowers, used in prescriptions for heart disease; and golden and rosy yarrow which King Achilles is said to have found and with them healed his men wounded in battle.

The mints grow in variety and, like many other herbs, have divers uses and cannot be separated as medicinal, fragrant, and culinary. Here also grow herbs native to North America, for the Indians of the New World were versed in the use of herbs: the monardas, American pennyroyal (*Hedeoma pulegioides*), and wild ginger (*Asarum canadense*). Here, too, are herbs held in esteem in the *Doctrine of Signatures,* when it was believed that the appearance of a plant indicated its medicinal use—for example, lungwort with its spotted leaves was supposed to heal diseases of the lungs. And other herbs such as *Atropa belladonna,* a source of atropine, and poison-hemlock (*Conium maculatum*) from which supposedly was prepared the drink that poisoned Socrates.

Dr. William J. Robbins, Executive Director of the American Philosophical Society, then Director of The New York Botanical Garden, in discussing the renewed interest in herbs before a meeting of the Herb Society of America, said, "The development of organic chemistry and the synthesis in the laboratory of chemical compounds of therapeutic importance resulted for a time in a loss of interest in the medicinal potentialities of herbs. There is now, however, a realization that plants are greater chemists than we are in our laboratories, and that the biological significance of their chemical products should not be overlooked."

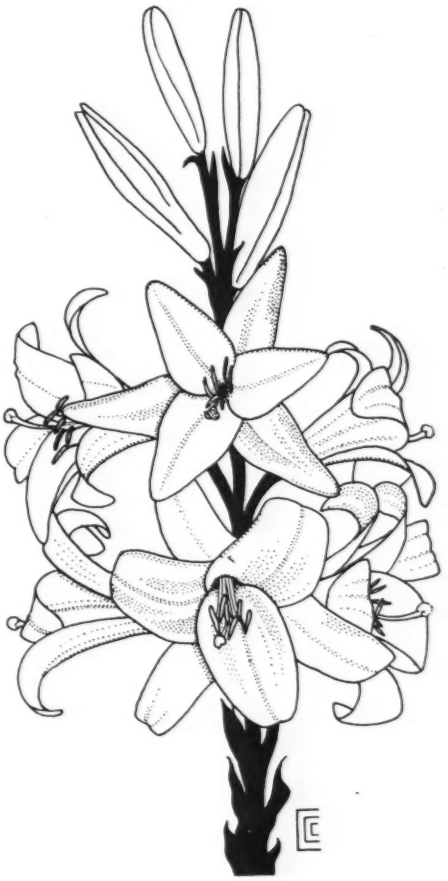
Among fragrant herbs. we again go back to the earliest records. In the *Book of Exodus*, we find our first formula for perfume, and Solomon sings:

> "Awake, O north wind: and come, thou south: blow upon my garden, that the spices thereof may flow out."

And surely from these herb gardens fragrance does go forth. In them the oldest roses in cultivation are not overlooked. There are *Rosa damascena*, brought to England by the Crusaders and one of the sources of attar of roses, and *R. gallica*, the Provence or French rose, that gives a lasting scent to potpourri. Another fragrant flower from the East is the Madonna lily; once established, it will make large patches. Lavender and rosemary are regarded by many as the herbs of enchantment — lavender, reminiscent of the beauty and fragrance of old English gardens, and rosemary, redolent of incense, enveloped in legends from Egypt, and growing riotously on warm hillsides in countries bordering on the Mediterranean. From Richard Banckes' *Herball* (1525) we learn that rosemary never grows higher than the height of Christ when he was a man on earth, and that after thirty-three years the plant increases in breadth but not in height. Southernwood (*Artemisia abrotanum*) was brought to America by our forefathers; many of us remember how we picked an aromatic sprig from this shrub, prominent in our grandmothers' gardens, to tuck into our belts. Meadowsweet (*Filipendula ulmaria*) is a "strewing herb—Queen Elizabeth I ordered that it be spread on the floors of her palace. The rhizomes of *Iris germanica* and variety *florentina* are dried and ground as a fixative for flower odors, and in Colonial days were used to starch and scent linens. These and many others are growing in the collection of fragrant herbs.

In the herb gardens, annual, biennial, and perennial culinary herbs flourish—the thymes and sweet marjoram which soften the edges of a walk, lovage whose leaves taste like celery, spicy basil, dark

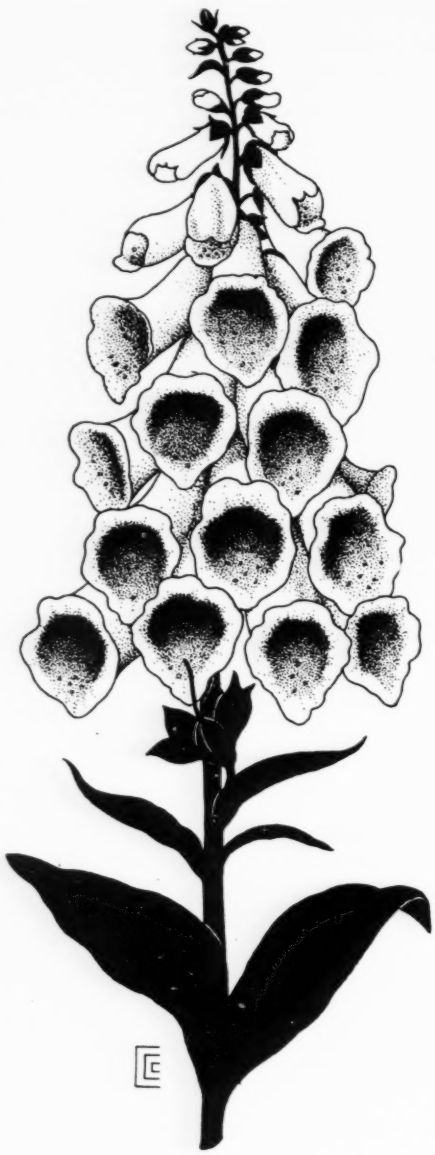
Madonna lily, *Lilium candidum.*



green savories, and the angel's herb or biennial angelica, to name only a few. Their stories are found on clay tablets of ancient Nineveh, inscribed with hieroglyphics on papyrus, mentioned in Biblical tithes, and written of in Greek and Roman histories. Their seeds traveled over the old trade routes to Europe. Their uses were recorded by hand in illuminated lettering on parchment in ancient monasteries. Printing made available to us their uses in the Still-room — through the old garden and cook books of Elizabethan England. From Colonial America the records of the herb garden at Mount Vernon, left by George Washington, attest their use.

In present-day living the importance of culinary herbs has not been overlooked, if one judges by the numerous articles in magazines and newspapers and the cook books on the subject. Grocery stores present their racks of assorted herbs, and the United States Government issues herbs to the commissaries of the armed forces. However, the cook should exercise discretion in the use of herbs. It is better to under-season than to over-season, for it is well to remember that the dried product is more potent than the fresh.

Foxglove, *Digitalis purpurea.*



Sage (*Salvia officinalis*), called "magic feather" by the Indians, is familiar in poultry dressings. Try it in pea soup. A leaf of rose-geranium (*Pelargonium graveolens*), baked in the bottom of a cake, will take you back in memory to your grandmother's tea-table. Your guests will be intrigued by the flavor of sassafras (*Sassafras albidum*) grated over apple pie or of a lemon-verbena leaf (*Lippia citriodora*) cooked in jam tarts. The savories are perfect condiments for vegetables—and what would tomatoes be without basil? In early days Bible leaf (*Chrysanthemum balsamita*) was used to mark a passage in the Bible or to nibble during prolonged sermons. Today, its broad leaf in an "old-fashioned" adds flavor—and conversation!

As in all gardens, it is not to be expected that the present plantings will remain static. Because of lack of space it has been necessary to omit interesting and useful herbs. There will be replacements, and also additions of herbs that so far have not been available, since there is a constant exchange of plants and seeds with botanical and horticultural institutions in this country and abroad.

A visit to these gardens will inspire flower arrangers to make use of herbs, for herbs will suggest new ideas in form, color, texture, and line. There is wide variety in leaf patterns from the large velvety *Pelargonium tomentosum*, the curling lady's-mantle (*Alchemilla vulgaris*) which, when folded, looks like a design for the cloak of a great lady, the glowing *Perilla*, to the lacy kinds of *Artemisia*. Then the flower-capped alliums are stunning in mass arrangements. When dried, flowers, foliage, and seed pods are excellent decorations to repeat summer colors in muted beauty.

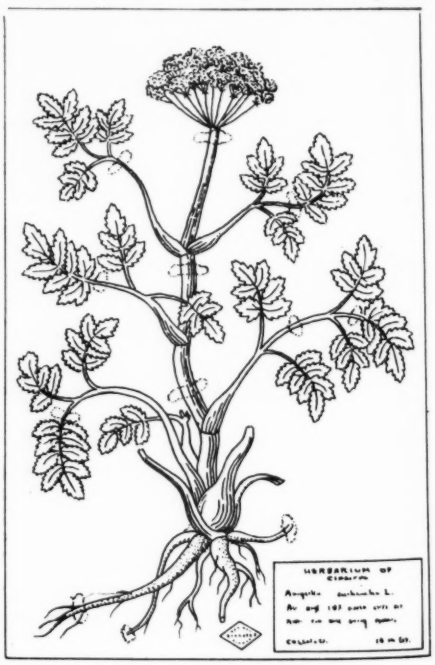
It is essential to have a collection of well-dried and scientifically prepared plant specimens for study. In 1952, at the suggestion of T. H. Everett, then Horticulturist, now Assistant Director (Horticulture) and Curator of Education, the New York Unit of the Herb Society of America, with the help of the botanical staff, established its own collection of herb specimens in the Garden's Herbarium. The Herbarium is located in the Museum and Administration Building.

The very great service of the Library of The New York Botanical Garden is reflected in the plantings of the herb garden. In the Library are monographs, periodicals, reprints, bulletins, and other papers in this specialized field. A part of the main reading room is devoted to current books on herbs. In the Barnhart Room are several hundred volumes, some beautifully illustrated, representing the herb literature of four centuries.

The enthusiastic understanding and admirable cooperation of the Librarian, Miss Elizabeth Hall, encourage the student. Miss Hall gives help, whenever needed, on many kinds of herbal problems.

All who are interested in growing herbs, or have the creative impulse to use them in the various ways in which they may be employed, will find at The New York Botanical Garden information and enjoyment in the Herb Garden and in the adjacent study collection of herbs, in the Herbarium, and in the Library.

Herbarium sheet of *Angelica archangelica.*



Above. These flowers, more than twice their usual size, were found in a remarkable colony of *Rhododendron calendulaceum* near Burningtown Gap, North Carolina.
Upper right. *Rhododendron cumberlandense* is of superior garden quality.
Lower right. A good ornamental form of *Rhododendron austrinum.*

NATIVE EASTERN AZALEAS

By David G. Leach

Mr. Leach is a geneticist whose hobby is hybridizing rhododendrons on a fairly large scale.

He spent the first three months of this year in Queensland, Australia, searching for *Rhododendron lochae,* and in Malaya, Thailand, and Cambodia scouting some of the rare lepidote rhododendrons. His book, *Rhododendrons of the World,* will be published by Scribners late in the spring or early summer 1960.

The following is based on the talk given by Mr. Leach at the annual meeting of the American Rhododendron Society, in Portland, Oregon; published originally in the Society's Bulletin and since rewritten, in parts, to direct it to a more general audience.

THE OCCIDENT was passed over lightly in the distribution of rhododendrons. Only about three per cent of the world's eight-hundred-odd species are native to Europe and America combined, with the United States enjoying the majority. But in deciduous rhododendrons (azaleas) the eastern portion of our country is the richest in the world.

Of the eighteen species in the Luteum Series, all but three are native to the states east of the Mississippi, and we have as a bonus two species in the Canadense Subseries. Most of these are fine ornamentals which have been rather badly neglected. The representatives of our eastern native azaleas that are occasionally seen in our gardens, are almost all inferior forms, far less attractive than the best that this handsome group offers. Perhaps because of unfamiliarity with the better forms, gardeners do not discriminate between the undistinguished average and the exceptionally superior, which is the normal ornamental range to be found in all the native azalea species.

Deciduous azaleas are highly evolved rhododendrons, the end-product of a long line of ancestors that included magnolias (magnolia family) and continued through camellias (tea family) into the heath family to which they, the azaleas, belong. During the imperceptible tide of geologic epochs, the Stamineum Series of *Rhododendron* made its appearance, followed by the Ovatum Series and the Albiflorum Series, and finally the Subseries Canadense *(Rhodora)* was evolved. The Obtusum Subseries (persistent-leaved) descended next, and from it came the deciduous azaleas of the Luteum Subseries as we know them today. The evidence for such a family tree is persuasive. The native American azaleas are of ancient lineage, among the aristocrats of the genus *Rhododendron* in the length of their patrician pedigree. But like many aristocrats they are all related, sometimes a little too closely for the convenience of those interested in unraveling their ancestry. The eastern azaleas are, for the most part, not at all well defined. There has been an enormous amount of crossing in the wild. In some locations in the North Carolina mountains, it is often

Rhododendron oblongifolium.

difficult to find a typical specimen with the classic characteristics of its species amid the welter of natural hybrids. Man has hastened the appearance of vast numbers of these hybrids by clearing the land, burning over scrub areas, making roads, and otherwise creating new ecological niches into which nature's hybrids can fit at a selective advantage. In fact, it seems that the natural hybrids spring up almost unfailingly to exploit the new environment.

I find it easiest to keep in mind the native azaleas by classifying them in color groups: the early whites (*R. alabamense, R. atlanticum*); the early midseason pinks (*R. canescens, R. nudiflorum, R. roseum*); the species in the red-yellow-orange group (*R. austrinum, R. speciosum, R. calendulaceum, R. bakeri, R. prunifolium*); and the late whites (*R. arborescens, R. viscosum, R. oblongifolium, R. serrulatum*).

Taking them in this sequence, *R. alabamense* is a rare species that is found only in the central part of northern Alabama. It is a little azalea of convenient height, rarely more than four feet tall, and blooms rather early in the total sequence of eastern azalea flowering. It is usually described as stoloniferous, but the plants in my garden have not been so, and those that I have seen in the wild can safely be said to be much less strongly stoloniferous than *R. atlanticum*, for example. Good forms of *R. alabamense*, with broad corolla lobes, make handsome shafts of white in the forefront of an azalea planting. The easiest way to identify this species is by crushing the foliage. The definitive jasmine or lemon scent from the foliage, in combination with the white flowers similarly fragrant, is a usually reliable means of identification. If the blossoms are pale pink, the plant comes from a natural cross with *R. canescens*, a species with which it is much too familiar.

The other "early" white is *R. atlanticum*, closely related to *R. alabamense*, but with a distribution ranging from southern Pennsylvania to South Carolina. Low-growing and strongly stoloniferous, this azalea forms colonies as much as twenty-five feet across and probably could be demonstrated to spread even farther, if anyone cared to determine the limits of a single plant by untangling it from a large stand. A young plant is apt to be a little diffuse in its ornamental effect, with a cluster of flowers atop each stem about twenty inches high; but when a sizable clump has been formed, this species is extremely effective as a dwarf azalea in the garden. Unfortunately, it is rare to find *R. atlanticum* in its typical form. I have seen it so only along the Seaboard Railway route near the northern border of North Carolina. Dr. Henry Skinner, Director of the U.S. National Arboretum, found typical plants also on the Delmarva Peninsula of Delaware. An easy identification can usually be made by the five rows of stalked glands near the tip of the dormant floral bud; but there are plants, six feet tall, in southeastern Pennsylvania which correspond in every botanical detail with *R. atlanticum*. Such giants, and smaller plants with pink flowers, are usually the result of natural hybridization with *R. canescens* in the South, or with *R. nudiflorum* in the North.

In the pink-flowered group of native azaleas, *R. canescens* comes into blossom first. It reaches up to fifteen feet, as found from North Carolina to Florida and westward into Texas, and it has been, I think, a little maligned as a garden decoration. The usual comment in books is that the ornamental effect of *R. canescens* can be obtained also by *R. roseum* and *R. nudiflorum*, which are hardier and generally superior. However, they do not bloom at the same season. *R. canescens* flowers a good deal earlier, at least in my garden in Pennsylvania, and its finest forms are absolutely first-rate, free-blooming, and effective garden shrubs. The rare and appealing salmon-pinks are not duplicated in the northern species, either. I shall concede only that the average quality of *R. canescens* for cultivation is below that of its northern relatives.

This species blooms along the edge of woodlands in late March in southern Georgia, where it often catches the eyes of tourists homebound from Florida. The flower color is apt to be pale and undistinguished, the blossoms rather small and somewhat crumpled, but superior forms farther north produce some plants with handsome blooms.

In the pink-flowered class of eastern native azaleas, *R. nudiflorum* follows next in bloom. This is usually a tall, vigorous shrub whose range extends from Massachusetts to North Carolina and westward into Indiana. Its western limit of distribution is often erroneously given as Ohio. Good forms of *R. nudiflorum* are remarkably fine ornamentals, free-flowering, easy to please, and covering themselves with a pale to deep pink blanket of blossoms. Poor forms tend to have twisted flower lobes and rather small blossoms of pallid color and a somewhat wrinkled appearance. The classic quick distinction from *R. roseum* is based on scent: *R. nudiflorum* has a sweet fragrance and its near relative a clove-like, spicy one. I find it easier to distinguish the two by their hairiness—*R. nudiflorum* is essentially without hairs on the dormant floral buds and *R. roseum* hairy. In Pennsylvania, at least, *R. nudiflorum* is likely to be found at lower elevations and *R. roseum* farther up the mountains. These two are often confused; I have seen one of the species labeled with the name of the other at one of the great flower shows in London.

Rhododendron nudiflorum and *R.*

Rhododendron canadense forma *albiflorum.*

roseum are reported to interbreed freely, but in this part of the state of Pennsylvania, where both are abundant, natural hybrids are not common. They are pretty well confined to narrow zones, where *R. nudiflorum* on the lower slopes overlaps *R. roseum* coming down from the higher.

Rhododendron roseum, in bloom at the same time, appears to be the more primitive and must be credited with being superior. It is found from New England to Virginia and westward into Missouri. Some forms have pink flowers, some have flowers so pale they are almost white, and others have flowers so deep they are almost red. The best forms, in my opinion, surpass in beauty any of the commercial modern azalea hybrids.

Many gardeners have become so preoccupied wtih large flowers that they forget that a profusion of smaller blooms may actually be more colorful than bigger blooms borne in clusters farther apart. In addition, there is in *R. roseum* and other azalea species a natural beauty arising from the subtle balance between size of flower and leaf and from their proportion as related to the structure of the branches. Here is a high standard of grace and distinction, which seems lacking in some of the commercial modern hybrids. The latter have their attractive features, but my plea is that we do not overlook the virtues of the species. There is plenty of room for them, not as botanical curiosities, but for their contributions as fine garden plants. *R. roseum* in its best forms qualifies on every score.

Rhododendron austrinum is the first to bloom in the red-yellow-orange group. It appears to be a primitive ancestor of the well-known flame azalea, *R. calendulaceum*. In its typical form, as seen in the lowlands of Georgia and Alabama and, to some extent, in northern Florida, it does not offer much as an ornamental, because its pale yellow flowers with reddish stripes on the outside are rather small and spidery in effect. But there are forms of *R. austrinum* which bear larger, handsome orange or clear yellow flowers, many in a cluster. Then it is a striking plant and one that is in flower before its color range is available from any other deciduous azalea. It is an upright shrub of medium size.

Next to bloom in this group is *R. speciosum*. No hybrid I have yet seen equals the incandescent reds, the luminous yellows, and the soft pastel blends of the superior forms of this species which are found in the lowlands of Georgia and South Carolina. *R. speciosum* is most often a shrub six or seven feet tall, and it is very free-blooming under cultivation. Natural hybrids with *R. canescens*, easily found in the wild, are stunning when mantled with their pale to vivid pink flowers. *R. speciosum* is easily distinguished from *R. calendulaceum*, because it is essentially nonglandular where the latter is glandular. Textbooks fail to mention that *R. speciosum* is also usually less vigorous and has a more delicate, graceful character

Rhododendron vaseyi var. *album* 'White Find'.

—because it is lighter in texture, a little smaller in leaf, and thinner in branch—than *R. calendulaceum*.

Rhododendron calendulaceum has been recognized for generations as a fine ornamental, but the very best forms are rarely seen in cultivation. This species seems to have descended from the early-blooming *R. austrinum* and the late-blooming *R. prunifolium*, and to have inherited the finest traits of each. It is an upland azalea, found at the higher elevations from Pennsylvania to Georgia, and the greater the altitude the deeper the color is likely to be. Unfortunately, the brilliant reds usually fade when the plants are dug and taken to gardens at lower elevations, but the yellows and orange are often extraordinarily effective. In some forms the blossoms are borne in globular trusses which have a grace lacking in the large-flowered garden hybrids. The forms with apricot-colored blooms are exceptionally appealing. The so-called "pink calendulaceum" and "white calendulaceum" result from natural crosses with *R. arborescens*.

A few years ago I was taken, with several others, by Dr. W. N. Fortescue to a site near Burning Town Gap in North Carolina. There we came across a stand of *R. calendulaceum* whose clear orange flowers were marked by a bold golden shield on the upper

Rhododendron bakeri.

lobe. The blossoms were about two and a half times larger than the average for the species, almost Oriental in their brilliance. This remarkable find points up the importance of obtaining the very best forms for garden use of the variable deciduous azalea species.

Rhododendron bakeri can best be described as a superior, later-blooming *R. calendulaceum*. I consider it a finer species because it is more compact in growth, not often over six or seven feet in height; because it holds its foliage in good condition to the end of the season; and because it blooms in late June. Its color includes not only yellows and orange, but also remarkable electric reds which retain their brilliance when the plants are grown at low altitudes. The fine forms bear clearly defined trusses of many flowers.

Where *R. bakeri* and *R. calendulaceum* occur at different altitudes so that their blooming seasons overlap, natural hybrids between the two are found. Offspring from crosses with *R. arborescens* in the wild are obtained in unusual pink shades, highly decorative for garden use.

Some years ago about sixty plants of Dr. Braun's *R. cumberlandense* were collected for me southwest of Cumberland, Kentucky. These have developed into a phenomenal group of azaleas, all

of outstanding garden quality, and have become the principal display of my garden in late June. As I believe they may be unique in cultivation, I have distributed seeds freely to botanical gardens, nurseries, and amateur enthusiasts.

It has been suggested that *R. cumberlandense* should be merged in *R. bakeri*, as there is not sufficient distinction to warrant two separate species. This particular group of *R. cumberlandense* has a different character and habit of growth from any *R. bakeri* that I grow or that I have seen elsewhere. The colors range from clear orange to blazing scarlet, with the majority in brilliant reds; the flowers are well presented. They are superior to "Camp's Red." I have not made a minute botanical comparison of the plants in this group with *R. bakeri*; but I am confident that there exist species of *Rhododendron* with less difference between them than that between *R. bakeri* and *R. cumberlandense*, as I know them from my own plants.

The last to come into flower of the yellow-orange-red group is *R. prunifolium*, a rare lowland species from a limited area along the Georgia-Alabama border. This azalea received a First-Class Certificate from the Royal Horticultural Society; it is certainly valuable for garden decoration, flowering in August and even in September when color from woody shrubs is at a premium. Orange and yellow flowers are seen occasionally, but the flowers are usually red—the best forms a vibrant red which shines in the landscape. *R. prunifolium* grows as much as fifteen feet tall.

When I scouted this species in the wild, it seemed to me to prefer low spots and shallow valleys, which possibly indicates a preference for moisture. Since it comes from such a limited geographic area, its hardiness might be expected not to vary appreciably, but some plants in my cold garden appear to be more bud-hardy than others.

The late whites, *R. arborescens, R. viscosum,* and *R. oblongifolium*, bloom about the same time, early July, in my garden, with *R. serrulatum* following much later, in early August. In the wild they vary considerably in every respect —the first three cross at every opportunity with other azaleas nearby. All are fragrant. *R. oblongifolium*, which comes from Arkansas, Texas, and Oklahoma, offers nothing unique as a garden plant. *R. arborescens* is probably superior to *R. viscosum* on the average; in its finest forms it is an extremely valuable azalea, for its cool-looking, immaculate white flowers appear just as the hot weather begins. On poor forms, the flower trusses are hidden by new growth and may have either under-sized flowers or narrow corolla lobes. As it ages, *R. arborescens* becomes a very large, spreading shrub; with its white flowers in bold contrast against the glossy foliage and scenting the garden for some distance, it is one of the stars of the genus. Its natural hybrids, resulting from repeated back-crosses with *R. bakeri* in the wild, are often remarkably beautiful in pastel pink and ivory and white.

Rhododendron arborescens has smooth branchlets and those of *R. viscosum* are bristly. If you have a late white azalea species and are wondering which species it is, this is an easy way to tell the difference. *R. arborescens* occurs from New York to Alabama, *R. viscosum* from Maine to South Carolina; where they overlap, they interbreed freely. In the Northeast *R. viscosum* is usually found near water, but it grows well in any average garden soil and varies a great deal in stature, from dwarf and stoloniferous to large and upright. The best forms seem to be intermediate in stature, vertical in growth habit, and to have flowers with shorter tubes, more abruptly dilated, which are freely borne in a forward position so that they are not hidden by the new growth. It blooms about the same time as *R. bakeri* and its blue-green foliage furnishes a pleasing contrast.

Rhodendron serrulatum is the latest-blooming species in the entire genus and can be found flowering in early November in central Florida. It is similar to *R. viscosum* but usually not quite so decorative. However, its white flowers with long tubes can provide an interesting note to northern gardens in August.

Rhododendron serrulatum.

Turning now to the two eastern species in the Canadense Subseries, we note that *R. canadense* comes into flower early, long before the azaleas of the Luteum Series make their contribution. This is the azalea beloved by poets, the rhodora, a neat little dwarf with grayish green foliage. It grows about three feet tall, spreads by underground stolons, and soon forms a nice clump which bears many small lavender-rose blossoms atop the naked stems. I am especially fond of forma *albiflorum*, whose white flowers are the first to usher in the azalea season each year. *R. canadense* extends its natural range from Labrador and Newfoundland to northern New Jersey. In the garden it wants a more acid soil than the other azaleas.

Rhododendron vaseyi blooms only a little later than *R. canadense*. I count it among the finest of all azaleas, but it is extremely variable in its ornamental value. I have some plants with flowers twice the size of others. The blossoms may be a pallid pink or they may be, in the wilderness, a velvety crimson which becomes a deep, rich pink in gardens at lower elevations. There is a strikingly beautiful, large-flowered white, called 'White Find', this was introduced by LaBars' Rhododendron Nursery, of Stroudsburg, Pennsylvania. Interplanted with the deep pink form, 'White Find' creates a scene of remarkable distinction—the myriad flowers poised on the branch tips suggest they are swarming pastel butterflies.

Rhododendron vaseyi comes from the mountains of North Carolina. It makes an upright shrub, old specimens as much as twelve feet tall, with an oddly light and graceful appearance when in bloom. It is highly regarded in Europe and sadly neglected in this country. I have never succeeded in crossing it with any other azalea, not even with *R. canadense* in its own subseries.

With the eastern natives contributing their wealth of bloom, azaleas can be had in flower from early spring until early fall, months before and months after the cultivated hybrids put on their show. The difference between the best and the poorest in each species is the

(Continued on page 107)

Dear Member:

In this special insert of *The Garden Journal*, we present the 1960 bulb list, available only to members of The New York Botanical Garden.

The varieties of hyacinths, tulips, narcissi, crocus, and miscellaneous bulbs have been carefully selected to include those which have been in demand over the years because of their fine performance, and some of the very choice recent introductions. These bulbs are of high quality – from a Holland grower who has the reputation of furnishing only the best – and of the particular sizes recommended to give satisfaction. The sizes are expressed in centimeters; for example, hyacinths 17-18 cms.

Prices are, in the main, the same as last year with the exception of the novelties and a few of the older varieties on which stock is limited this year.

We hope you will take advantage of this comprehensive offering of excellent bulbs to enrich the beauty of your spring garden next year.

In preparing your order, please:

1. Make sure that additions and Grand Total are correct.
2. On this special insert, make a record of the bulbs you have ordered. BULBS WILL BE IDENTIFIED BY NUMBER ONLY when you receive them.
3. *Print* shipping label in *ink*.
4. Draw check for Grand Total payable to The New York Botanical Garden.
5. As soon as possible, but not later than July 25, tear out page with order blank and shipping label and mail it with your check to:

   The New York Botanical Garden
   Department B
   Bronx Park
   New York 58, N. Y.

6. If you do not receive your bulbs by October 25, 1960, call Mrs. Hansell at The New York Botanical Garden – LUdlow 4-8500.

HYACINTHS

Hyacinths are excellent for the garden and are used for forcing. These are 17-18 cm. bulbs—the size recommended for all purposes; in pots and pans for forcing and for the garden.

Pink

1. GERTRUDE — $2.25 Rosy pink, compact flower. Medium early.
2. LADY DERBY — $2.25 Fine light pink, large bells.
3. PINK PEARL — $2.25 Deep rosy pink, large spike. Early.
4. QUEEN OF THE PINKS — $2.25 Bright rosy pink; large spike of fine bells. Late forcer, good for bedding.

Red

5. JAN BOS — $2.25 Beautiful scarlet. Very early.
6. LA VICTOIRE — $2.25 Brilliant carmine-red. Early.

White

7. EDELWEISS — $2.25 Pure white, broad compact spike.
8. L'INNOCENCE — $2.25 Pure white, very large well-shaped bells. Early and excellent for forcing.

Yellow

9. CITY OF HAARLEM — $2.25 Yellow, large spike, extra fine.
10. YELLOW HAMMER — $2.25 Yellow, large broad spike.

Light and Dark Blue

11. BISMARCK — $2.25 Sky-line, large spike, excellent for early forcing.
12. DELFT BLUE — $2.25 Bright porcelain-blue, compact spike.
13. DR. STRESEMANN — $2.25 Bright blue, large bells.
14. GRAND MAITRE — $2.25 Deep porcelain-blue.
15. KING OF THE BLUES — $2.25 The best dark blue; large well-formed spike on short stem. Late forcer.
16. MYOSOTIS — $2.25 Pale blue, long spike. Good forcer.

SINGLE EARLY TULIPS

Early tulips always make a splendid striking effect in any garden, whether planted in beds or smaller groups in borders. Size of bulbs, 12 cms. up.

17. COULEUR CARDINAL — $1.65 Brilliant crimson, slightly dewed outside.
18. GENERAL DE WET — $1.45 Orange, one of the most effective varieties for forcing and bedding, sweet scented.
19. KEIZERSKROON — $1.65 Bright red with broad golden-yellow border.
20. PRINCE OF AUSTRIA — $1.45 Orange-red, brilliant scarlet inside; very sweet scented.
21. URSA MINOR — $1.45 Deep golden-yellow.
22. VAN DER NEER — $1.45 Clear deep violet.
23. WHITE HAWK — $1.45 Pure white.

DOUBLE EARLY TULIPS

These tulips bloom a little later than single early tulips, and are excellent for planting in beds or borders. Size of bulbs, 11 cms. up.

24. BOULE DE NEIGE (Snowball) — $1.85 Large pure white.
25. MARECHAL NIEL — $1.75 Golden-yellow, flushed salmon-orange.
26. MR. VAN DER HOEF — $1.85 Pure golden-yellow.
27. MURILLO — $1.85 White, shading to delicate pink.
28. MURILLO MAXIMA — $1.85 Sport of Murillo, taller and earlier.
29. SCHOONOORD — $1.85 Snow-white.
30. TEAROSE — $1.90 Soft yellow, slightly shaded apricot.
31. VUURBAAK — $1.85 Scarlet; large flower on strong stem. Late.
32. WILHELM KORDES — $1.85 Bright orange, flushed red.

DARWIN TULIPS

No tulips equal the Darwin tulips in splendor and usefulness for various purposes. Size of bulbs, 12 cms. up.

33. AFTERGLOW — $1.25 Fine orange-rose with distinct orange edge.
34. BARTIGON — $1.05 Clear crimson-red.
35. CHARLES NEEDHAM — $1.30 Brilliant scarlet.
36. CITY OF HAARLEM — $1.25 Brilliant scarlet.
37. CLARA BUTT — $1.05 Clear self-colored salmon rosy pink.
38. FARNCOMBE SANDERS — $1.05 Fiery rose-scarlet.
39. GLACIER (syn. Wildlust) — $1.45 Ivory-white.
40. GOLDEN AGE — $1.25 Deep golden-yellow, shaded orange.
41. INSURPASSABLE — $1.05 Large lilac flower.

Price per Dozen, Except Where Noted.

42. LA TULIPE NOIRE – $1.25 Flower of a unique color.

43. NIPHETOS – $1.25 Ivory-yellow, large flower of good substance.

44. PRIDE OF HAARLEM – $1.05 Cerise-scarlet, a stately plant for borders and amongst shrubs.

45. PRIDE OF ZWANENBURG – $1.45 Pure salmon-pink, large flower.

46. PRINCESS ELIZABETH – $1.15 Vivid rose-pink.

47. PRINCESS ELIZABETH MAXIMA ..... $1.15 Large-flowering sport of Princess Elizabeth.

48. QUEEN OF BARTIGONS – $1.45 Pure salmon-pink.

49. RED PITT – $1.05 A bright red sport of William Pitt.

50. SCOTCH LASSIE – $1.05 Deep lavender.

51. THE BISHOP – $1.25 Bright violet-blue, large flower.

52. WILLIAM PITT – $1.05 Cerise-red with a darker shade on the outer petals.

53. WM. COPELAND – $1.05 Lovely lilac.

54. ZWANENBURG – $1.25 Pure white, large flower.

DARWIN HYBRID TULIPS

A new race of tulips, the results of crossings between Darwin tulips and Fosteriana varieties. They have enormous flowers on strong stems and vivid colors. Size 12 cms. up.

55. GENERAL EISENHOWER – $1.45 Orange-red.

56. GUDOSHNIK – $2.75 Yellow, spotted red.

57. HOLLAND'S GLORIE – $1.60 Orange-scarlet, black base.

58. LEFEBER'S FAVORITE – $1.45 Glowing scarlet, yellow base.

59. RED MATADOR – $1.25 Carmine-scarlet.

60. ROOSEVELT – $1.65 Clear orange-red, extra large, well-formed flower.

SINGLE LATE OR COTTAGE TULIPS

Cottage tulips have various shaped flowers and habits and are splendid for gardening purposes and cut flowers. Size of bulbs 12 cms up.

61. CARRARA – $1.05 Pure white.

62. DIDO – $1.25 Orange-rose, margined orange-yellow.

63. GOLDEN HARVEST – $1.05 Deep lemon-yellow, large flower.

64. INGLESCOMBE YELLOW – $1.05 Canary-yellow, fine bedder.

65. MARJORIE BOWEN – $1.05 Salmon orange-rose, exquisite variety.

66. MRS. JOHN T. SCHEEPERS – $1.35 Pure yellow, large oval flowers.

67. PRINCESS MARGARET ROSE – $1.05 Yellow, edged and flushed orange-red, sport of Inglescombe Yellow.

68. SMILING QUEEN – $1.45 Beautiful satiny pink, with silvery edge.

69. WHITE CITY (MOUNT EREBUS) – $1.25 Pure white, creamy anthers.

LILY FLOWERING TULIPS

These tulips belong to the Cottage Tulip family and bloom at the same time. Their distinct shape, more or less resembling lilies, made it desirable to group them under a separate head. They are splendid for groups in borders and are very artistic cut flowers. Size of bulbs, 12 cms. up.

70. ALASKA – $1.45 Pure yellow, sweet scented.

71. CAPTAIN FRYATT – $1.45 Garnet-red, violet-blue center.

72. CHINA PINK – $1.35 Pink, white base.

73. MRS. MOON – $1.45 Pure yellow, elegant shape.

74. WHITE TRIUMPHATOR – $1.15 Pure white.

DOUBLE LATE OR PEONY FLOWERING TULIPS

They are splendid in borders and fine for cutting. Size of bulbs, 12 cms. up.

75. MAY WONDER – $1.60 Clear rose, somewhat lighter towards the base. Strong large flower on strong stem.

76. MOUNT TACOMA – $1.45 Pure white, large flower.

77. ORANGE TRIUMPH – $1.45 Orange-red, flushed brown and narrow yellow edge.

78. UNCLE TOM – $1.45 Dark, glittering red, extra double.

PARROT TULIPS

On account of their large heavy flowers Parrot tulips are not recommended for planting in beds. In groups and in borders, they are very effective and they are excellent for cutting. Size of bulbs, 12 cms. up.

79. BLUE PARROT – $1.05 Rich bluish heliotrope.

80. DISCOVERY – $1.65 Pink sport of Princess Elizabeth.

81. FANTASY – $1.05 Lovely soft rose with green streaks, inside salmon-rose; flowers on erect stems.

82. TEXAS GOLD – $1.05 Deep yellow sport of Inglescombe Yellow.

TULIP SPECIES (Botanical Tulips)

Top-size Bulbs

83. *Acuminata (Cornuta, Stenopetala)* – $1.85 Red and yellow; very long pointed flower.

84. *Clusiana* – $1.45 Outer petals cherry-red, inner petals white.

85. *Eichleri* – $1.65 Fine vermilion-orange.

Price per Dozen, Except Where Noted.

86. *Fosteriana* CANTATA – $2.75 Vermilion-red, foliage shiny green.

87. *Fosteriana* GALATA – $1.65 Orange-scarlet, yellow base.

88. *Fosteriana* PRINCEPS – $1.45 Orange-scarlet, very large.

89. *Fosteriana* RED EMPEROR (Mme LEFEBER) – $1.45 Dazzling vermilion-red.

90. *Fosteriana* PURISSIMA – $4.75 White.

91. *Kaufmanniana* – $1.45 The waterlily tulip, creamy yellow outside, shaded soft red, inside deep yellow.

92. *Kaufmanniana* CESAR FRANCK – $3.25 Deep yellow, outside red with yellow edge.

93. *Kaufmanniana* ELLIOTT – $2.20 Pure white, outside bright rosy red.

94. *Kaufmanniana* GAIETY – $2.95 White, outside red.

95. *Kaufmanniana* JOHANN STRAUSS – $2.20 White, outside blotched red.

96. *Kaufmanniana* SHAKESPEARE – $3.25 Salmon shades.

97. *Kaufmanniana* STRESA $2.35 Red, edged yellow.

98. *Kaufmanniana* THE FIRST – $2.20 Carmine, edged white.

99. *Kaufmanniana* VIVALDI – $2.75 Yellow, red spotted; inside cream with red ring.

100. *Praestans* FUSILIER – $2.20 Vermilion-orange, bunch-flowering.

101. *Sylvestris (Florentina Odorata)* – $2.20 Yellow, fragrant.

BREEDER TULIPS

With their dark colors in bronze, mahogany, orange and purple, they make a striking contrast with the bright colors of the Darwins. Size of bulbs, 12 cms. up

102. DILLENBURG – $1.05 Glowing salmon-orange.

103. INDIAN CHIEF (MEYERBEER) – $1.35 Coppery red flower of exquisite form on long stem.

104. LOUIS XIV – $1.45 Dark purple flushed with bronze, edging to golden-brown; inside purple.

105. PRESIDENT HOOVER – $1.25 Brilliant orange-red.

106. PRINCE OF ORANGE (ORANGE BEAUTY) – $1.25 Deep orange-red, golden-orange margin.

REMBRANDT TULIPS

Size of bulbs, 12 cms. up

107. AMERICAN FLAG – $1.45 Bright red, striped and flaked white.

108. CORDELL HULL – $1.05 Red, striped rosy and white, sport of Bartigon.

DAFFODILS AND NARCISSI

Very popular for gardening, splendid for cutting, and for forcing in large quantities, they have an important place in the world of bulbs. For naturalizing, planting in woodlands, no flower is so popular. Top-size, double nose I.

Yellow Trumpets

109. FLOWER CARPET – $2.40 Deep golden-yellow.

110. KING ALFRED – $2.10 Clear golden-yellow; great substance; excellent for forcing as well as for the garden.

111. MAGNIFICENCE – $2.20 Deep golden-yellow, good-sized flower on strong stem. Very early.

112. REMBRANDT – $2.30 Deep golden-yellow perianth and trumpet; flower of fine proportions.

113. UNSURPASSABLE – $2.75 Very large, golden-yellow.

Bicolor Trumpets

114. MUSIC HALL – $2.40 White perianth, yellow trumpet.

115. PRESIDENT LEBRUN – $2.40 Perianth white, trumpet lemon-yellow passing to creamy white.

116. QUEEN OF BICOLORS – $2.40 Perianth, white, trumpet canary-yellow, large flowers. Early.

117. SPRING GLORY – $2.40 White perianth, large yellow trumpet.

White Trumpets

118. BEERSHEBA – $2.20 Beautiful pure white variety.

119. MRS. E. H. KRELAGE – $2.10 Trumpet creamy, changing to pure white. Medium early.

Large-Cupped Narcissi

120. CARBINEER – $2.20 Broad flat yellow perianth, large cup, deep orange-red.

121. CARLTON (NIMROD) – $2.10 Uniform soft yellow; large cup, beautifully shaped. Early.

122. FLOWER RECORD – $1.80 White perianth, deep yellow cup edged orange.

123. FORTUNE – $2.20 Broad flat overlapping yellow perianth; very large, orange crown. Early.

124. JOHN EVELYN – $2.10 Large overlapping ivory-white perianth; large flat apricot crown, heavily frilled.

125. MRS. R. O. BACKHOUSE – $1.90 Ivory-white perianth; graceful apricot-pink trumpet with deeply fringed edge.

126. SCARLET ELEGANCE – $2.10 Perianth deep yellow; cup deep orange-red, scarlet edge.

127. SELMA LAGERLOF – $2.40 Large pure white perianth; red crown edged yellow.

128. SEMPRE AVANTI – $2.10 Creamy white perianth; large bright orange cup.

129. TUNIS – $2.20 Broad white overlapping perianth; large cup, soft primrose, shaded gold. Early.

Small-Cupped Narcissi

130. EDWARD BUXTON – $1.65 Light yellow perianth; deep orange cup.

Price per Dozen, Except Where Noted.

131. LA RIANTE — $1.65 Perianth pure white; cup deep red. Medium early.

132. VERGER — $1.80 Pure white perianth; deep red cup. Medium early.

Poeticus

133. ACTAEA — $1.65 Large pure white perianth of perfect shape; brilliant scarlet eye. Medium early.

Poetaz

134. CHEERFULNESS — $1.65 White perianth with fully double center of white and yellow. Medium early.

135. CRAGFORD — $2.30 White perianth; deep orange crown.

136. GERANIUM — $1.65 Round flat pure white perianth, deep orange-red cup. Very late.

137. LAURENS KOSTER — $1.65 White perianth; deep yellow cup. Well-known forcing variety. Early and free-flowering.

138. L'INNOCENCE — $1.65 Pure white perianth, cup canary-yellow.

139. YELLOW CHEERFULNESS — $1.95 Soft yellow, double.

Double Daffodils

140. INGLESCOMBE — $1.80 Uniform pale yellow. Medium early.

141. MARY COPELAND — $2.75 Outer petals pure creamy white, inner petals lemon-yellow and brilliant orange.

142. TWINK — $1.80 Semi-double, primrose with inner petals of light orange; tall strong stem.

Narcissus Campernelli and Jonquilla

143. *Odorus Rugulosus* (Single *Campernelli*) — $1.05 Golden-yellow flowers, two to four to a stem; fragrant.

144. *Odorus Plenus* (Double *Campernelli*) — $1.60 Fragrant double golden-yellow flowers on tall stem.

145. *Odorus* ORANGE QUEEN — $1.60 Deep orange-yellow flowers, two or three to a stem; free flowering.

146. *Jonquilla* Single — $.95 Sweet-scented, deep yellow, with rush-like foliage.

147. *Jonquilla* TREVITHIAN — $1.85 Pale lemon-yellow perianth, clear yellow cup.

Narcissus Species

148. *Bulbocodium* — $.95 Rich golden-yellow.

149. *Bulbocodium Citrinus* — $1.60 Sulphur-yellow.

150. *Cyclamineus* — $1.45 Clear yellow, reflexed petals.

151. *Cyclamineus* FEBRUARY GOLD — $2.10 Yellow perianth, trumpet golden-yellow.

152. *Triandrus Albus* (ANGEL'S TEARS) — $.95 Silvery white, two and more drooping flowers on a stem.

153. *Triandrus* SILVER CHIMES — $4.25 Four to six flowers on a stem, nodding and graceful. Pure white perianth, pale primrose cup.

154. *Triandus* THALIA — $2.30 Larger than *albus*, pure white.

155. W. P. MILNER — $1.85 Sulphury white, dwarf, free flowering.

CROCUS

Size of bulbs — 10 cms.

Blue and Purple

156. ENCHANTRESS — $.45 Soft blue.

157. GRAND MAITRE — $.45 Dark blue.

158. QUEEN OF THE BLUES — $.45 Porcelain-blue.

Striped

159. PICKWICK — $.55 Purple stripes on white base.

160. STRIPED BEAUTY — $.55 Blue, striped white.

White

161. SNOWSTORM—$.65 Pure white, free-flowering.

Yellow

162. YELLOW MAMMOUTH — $.40

CROCUS SPECIES

Top-size bulbs

163. *Chrysanthus* E. P. BOWLES — $.45 Yellow, outside purple.

164. *Chrysanthus* SNOWBUNTING — $.55 White, greyish feathers.

165. *Chrysanthus* ZWANENBURG BRONZE — $.45 Bronze.

166. CLOTH OF GOLD *(Susianus)* — $.30 Golden-yellow feathered brown.

167. CLOTH OF SILVER *(Versicolor)* — $.45 Silvery white, striped lilac.

168. *Etruscus* — $.40 Mauve.

169. *Sieberi* —$.40 Soft blue with orange stigma.

170. *Tomasinanus* — $.30 Pale lavender.

171. *Vernus* VANGUARD — $.45 Silver greyish lilac. Early.

MISCELLANEOUS BULBS

172. *Scilla campanulata* — $.60 In blue, pink, and white. Size of bulbs, 9-10 cms.

173. *Scilla sibirica* — $.60 Sky-blue.

174. *Scilla sibirica alba* — $.60 White. Size of bulbs, 8 cms. up.

175. *Galanthus nivalis* — $.60 Pure white. Size of bulbs, 6 cms. up.

176. *Chionodoxa luciliae* — $.35 Lilac-blue.

177. *Chionodoxa gigantea* — $.35 Light blue.

178. *Chionodoxa sardensis* — $.35 Bright blue.

179. *Muscari armeniacum* — $.35 Bright blue.

180. *Muscari botryoides coerculeum* — $.45 Blue.

181. *Muscari botryoides album* — $.45 White.

BULBS FOR NATURALIZING

Not ordered in dozen lots.

182. CHIONODOXA — $14.00 M; $1.45 C Mixed colors.

183. CROCUS — $23.00 M; $2.50 C — Size of bulbs, 8 cms.

184. NARCISSUS — $120.00 M; $12.50 C A fine mixture of types and colors. Top-size.

185. NARCISSUS — $80.00 M; $8.50 C First-size.

Price per Dozen, Except Where Noted.

GOLD MEDAL NARCISSI

A selection of choice varieties.

Yellow Trumpets

186. GOLDEN MARVEL—$4.65 Soft golden-yellow throughout; one of the best yellow trumpets ever introduced.

187. GRAPEFRUIT — $11.25 Soft lemon-yellow throughout, tinged with pale apricot.

Bicolor Trumpets

188. LANTANA — $6.00 Pure white perianth with large golden-yellow trumpet.

189. WORLD'S FAVORITE — $2.40 Pure white perianth with a very large, soft yellow trumpet.

Large-Cupped Narcissi

190. BAHRAM — $2.10 Yellow perianth with deep orange-red crown.

191. BERMUDA — $2.30 Soft yellow perianth; the large spreading crown, clear orange.

192. CHAMPAGNE — $3.25 Pure white perianth with creamy white, broadly edged apricot-pink cup.

193. DELIBES —$3.15 Round golden-yellow perianth with a flat orange-red crown.

194. DICK WELLBAND — $2.20 White perianth; rather flat orange cup.

195. DUKE OF WINDSOR — $3.60 White perianth; large spreading crown, orange-apricot.

196. FERMOY — $5.25 Pure white perianth; frilled bowl-shaped crown, orange-red.

197. LA ARGENTINA — $2.20 White perianth; heavily frilled and almost double crown is yellow and stained orange-scarlet.

198. MAKASSAR — $2.75 Golden orange-yellow throughout.

199. MARY ROOZEN — $2.40 Deep golden-yellow perianth; large and frilled crown glowing orange throughout.

200. PINK FANCY — $2.10 White perianth; large crown apricot, broadly margined soft pink.

201. RED GOBLET — $7.20 Deepest golden-yellow perianth; goblet-shaped crown, deep orange-red.

202. ROYAL CROWN — $2.40 Silvery white perianth; large heavily frilled crown of soft apricot.

203. TINKER — $2.60 Clear golden-yellow perianth; long goblet-shaped cup of brilliant orange-scarlet.

Small-Cupped Narcissi

204. CHUNGKING — $6.00 Clear golden-yellow perianth; intensely deep red shallow crown.

205. AMATEUR — $2.30 White perianth; large, flat, bright scarlet crown.

206. LADY KESTEVEN — $1.95 Snow-white perianth; cherry-red cup.

207. POLAR ICE — $2.20 Medium-sized pure white, with a frilled cup.

208. POMONA — $1.95 Pure white round perianth; shallow and spreading crown lemon-yellow, edged pale apricot.

Poetaz Narcissi

209. MARTHA WASHINGTON — $2.75 Strong white perianth; large orange cup; two, but mostly three flowers to a stem.

Double Daffodils

210. HOLLANDIA — $3.60 Golden-yellow flat perianth; only the crown is double, and deep orange-red.

211. MRS. WM. COPELAND — $2.40 Creamy white.

Price per Dozen, Except Where Noted.

ORDER BLANK

Please Order By Number Only — *Check Must Accompany Order*

Bulb No.	Quantity	Price Per Doz.	Amount
1		2.25	
2		2.25	
3		2.25	
4		2.25	
5		2.25	
6		2.25	
7		2.25	
8		2.25	
9		2.25	
10		2.25	
11		2.25	
12		2.25	
13		2.25	
14		2.25	
15		2.25	
16		2.25	
17		1.65	
18		1.45	
19		1.65	
20		1.45	
21		1.45	
22		1.45	
23		1.45	
24		1.85	
25		1.75	
26		1.85	
27		1.85	
28		1.85	
29		1.85	
30		1.90	
31		1.85	
32		1.85	
33		1.25	
34		1.05	
35		1.30	
36		1.25	
37		1.05	
38		1.05	
39		1.45	
40		1.25	
41		1.05	
42		1.25	
43		1.25	
44		1.05	
45		1.45	
46		1.15	
47		1.15	
48		1.45	
49		1.05	
50		1.05	
51		1.25	
52		1.05	
53		1.05	
54		1.25	
55		1.45	
56		2.75	
57		1.60	
58		1.45	
59		1.25	
60		1.65	
61		1.05	
62		1.25	
63		1.05	
64		1.05	
65		1.05	
66		1.35	
67		1.05	
68		1.45	
69		1.25	
70		1.45	
71		1.45	
72		1.35	
73		1.45	
74		1.15	
75		1.60	
76		1.45	
77		1.45	
78		1.45	
79		1.05	
80		1.65	
81		1.05	
82		1.05	
83		1.85	
84		1.45	
85		1.65	
86		2.75	
87		1.65	
88		1.45	
89		1.45	
90		4.75	
91		1.45	
92		3.25	
93		2.20	
94		2.95	
95		2.20	
96		3.25	
97		2.35	
98		2.20	
99		2.75	

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SHIPPING LABEL

ORDER **Nº 1236**

CONTENTS: Merchandise. Package may be opened for inspection.

SHIP TO: **Name** .....
(Please Print)

Street Address .....

City ..... **Zone No.** ..... **State** .....

Member's Name

Bulb No.	Quantity	Price Per Doz.	Amount
100		2.20	
101		2.20	
102		1.05	
103		1.35	
104		1.45	
105		1.25	
106		1.25	
107		1.45	
108		1.05	
109		2.40	
110		2.10	
111		2.20	
112		2.30	
113		2.75	
114		2.40	
115		2.40	
116		2.40	
117		2.40	
118		2.20	
119		2.10	
120		2.20	
121		2.10	
122		1.80	
123		2.20	
124		2.10	
125		1.90	
126		2.10	
127		2.40	
128		2.10	
129		2.20	
130		1.65	
131		1.65	
132		1.80	
133		1.65	
134		1.65	
135		2.30	
136		1.65	
137		1.65	
138		1.65	

Bulb No.	Quantity	Price Per Doz.	Amount
139		1.95	
140		1.80	
141		2.75	
142		1.80	
143		1.05	
144		1.60	
145		1.60	
146		.95	
147		1.85	
148		.95	
149		1.60	
150		1.45	
151		2.10	
152		.95	
153		4.25	
154		2.30	
155		1.85	
156		.45	
157		.45	
158		.45	
159		.55	
160		.55	
161		.65	
162		.40	
163		.45	
164		.55	
165		.45	
166		.30	
167		.45	
168		.40	
169		.40	
170		.30	
171		.45	
172		.60	
173		.60	
174		.60	
175		.65	
176		.35	
177		.35	

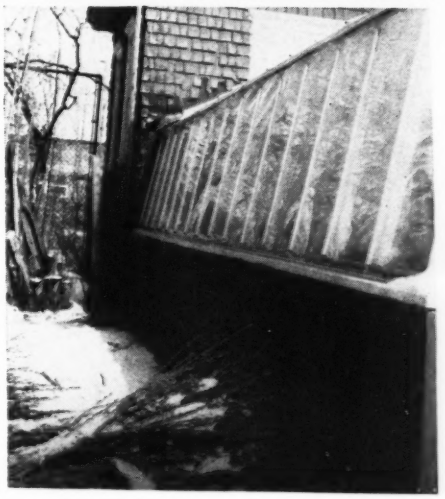
Bulb No.	Quantity	Price Per Doz.	Amount
178		.35	
179		.35	
180		.45	
181		.45	
182		14.00M	
182		1.45C	
183		23.00M	
183		2.50C	
184		120.00M	
184		12.50C	
185		80.00M	
185		8.50C	
186		4.65	
187		11.25	
188		6.00	
189		2.40	
190		2.10	
191		2.30	
192		3.25	
193		3.15	
194		2.20	
195		3.60	
196		5.25	
197		2.20	
198		2.75	
199		2.40	
200		2.10	
201		7.20	
202		2.40	
203		2.60	
204		6.00	
205		2.30	
206		1.95	
207		2.20	
208		1.95	
209		2.75	
210		3.60	
211		2.40	

GRAND TOTAL .....

MIST PROPAGATION

By Albert Lowenfels

Mr. Lowenfels, who is a member of The New York Botanical Garden, has been an amateur gardener for half a century. He has the distinction of being the only non-professional member of the Plant Propagators Society — this in recognition of his application of mist propagation of cuttings on his estate, Willow Lake Farm, in White Plains, New York.



The author's greenhouse is covered with plastic instead of glass and is interlined with lighter plastic to conserve heat. Above, entrance. Right, side view.

ESSENTIALLY every gardener is a propagator — he enjoys making things grow, then flower, bear fruit, and add to the beauty of his home grounds. But if more gardeners would learn how easy it is to start their own plants from cuttings, I am sure their pleasure in gardening would increase. For, after all, what greater joy is there than in creating something—and that is exactly what one does when he takes a seed or cutting and helps it to develop into a shrub or tree.

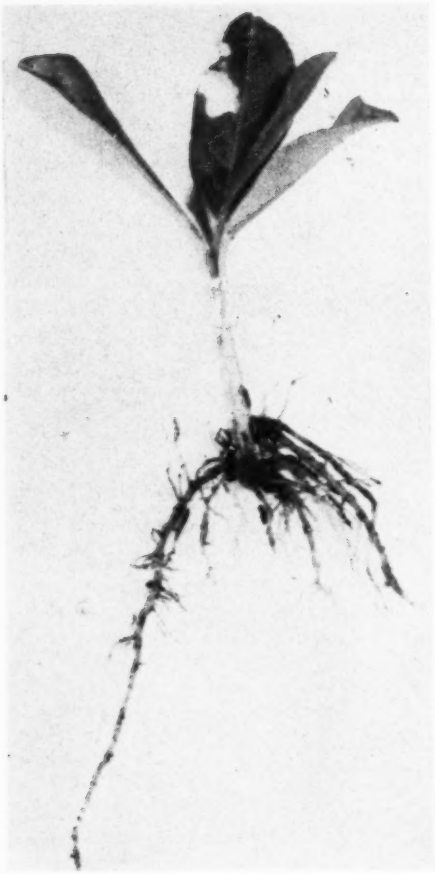
There are several ways to increase plants—by sowing seed, layering (including air-laying), grafting, budding, and taking cuttings. During the past ten years, tremendous strides have been made in the art of growing plants from cuttings, because of the introduction of the so-called plant hormones, which were developed by Drs. Zimmerman and Hitchcock at Boyce Thompson Institute for Plant Research and are now available commercially, and because of "mist" or "fog line."

One of the pioneers in the use of both plant hormones and mist is James S. Wells of Red Bank, New Jersey. And a commendable trait of Mr. Wells is his willingness to disseminate what he has learned about plant propagation through his articles in horticultural publications and through his book, *Plant Propagation Practices*. I became seriously interested in plant propagation when I visited the nursery in South Jersey that Mr. Wells was then managing. It was one of the hottest days I can recall, and I saw azalea cuttings turgid and thriving in that intense July heat because of the mist being sprayed on them.

When I returned to my home in White Plains, I removed the sash from a pit coldframe, purchased some pipe and nozzles (nozzles from oil burners), and in a few hours had constructed a mist system. Then I dug out the soil from the coldframe, placed good-sized bluestone on the bottom for drainage, and covered that with a mixture of sand and peat moss. With a garden hose, I connected the "fog line" over the newly made bed to a water line. Every morning the water was turned on, at night it was turned off; it was also turned off in rainy weather. The results were good, and I was fascinated by the possibilities. I planted cuttings of azaleas, yews, and a few other shrubs, dipping them in "Rootone," or "Hormodin," commercial plant hormone preparations.

That winter I studied the subject, reading all I could find about it. I learned, among other things, that all-day watering was not necessary, that better results were obtained with less water. So I bought a time clock and a water valve that operates on electric impulse (it is called a solenoid valve) and set them to turn on the mist six seconds out of every minute. I learned also—through a series of tests conducted by Boyce Thompson Institute—that one could take cuttings of lilacs in early May when the first flush of cutting growth starts. So I started with early May cuttings of lilacs and then continued to take soft green-wood cuttings of magnolias, pink dogwood, azaleas, and other plants all summer—in fact, until early September when I began to put in holly cuttings. Again the results were good.

The following winter at a meeting of the Plant Propagators Society, I met another leader in plant propagation, Harvey Templeton, Jr., of Winchester, Tennessee, and learned of his invention, the electronic leaf. This is a simple piece of plastic in which are imbedded two pieces of any good electrical conductor (carbon is one) connected to a small amplifier which resembles a one-tube radio set. This in turn is connected to the solenoid valve, and there is also a connection to a light socket for power. While this explanation may make the set-up seem complicated, it really is not complicated. The system is simply this: when the electronic leaf in the bed of cuttings becomes dry, the mist goes on; as soon as the leaf is wet, the mist goes off and does not start until the little electronic leaf is again dry. The advantage of



The fine root system on a magnolia cutting and, above right, a rooted cutting of a red maple — both from the author's propagating bench.

this system is that when it rains, or the atmosphere is full of moisture, the "leaf" calls for little water, and so the cuttings get only the amount needed.

Later I learned of another device which serves the same purpose. Two tubes, kept a fraction of an inch apart on a small wooden stand, are connected to a mercury switch which activates the solenoid valve. These tubes are inserted in the middle of the cutting bed; when a film of water from the fog line makes a contact between them, the water supply stops.

To make the system fully automatic, because I am at my office in New York City almost every day, I set an electrical clock to go on and off according to the length of daylight. For example, in the summer, the clock goes on at 7:45 in the morning and off at seven in the evening. Even when I am away from home for long weekends, the mist system has not failed to function.

Incidentally, special nozzles are now sold for mist propagation, and the entire investment for a fair-sized system need not be more than one hundred dollars. A smaller system which does not operate automatically—but can be modified to do so—is sold for about thirty dollars.

There are two theories on why mist helps cuttings to root: (1) As soon as a piece of a branch or cutting is taken

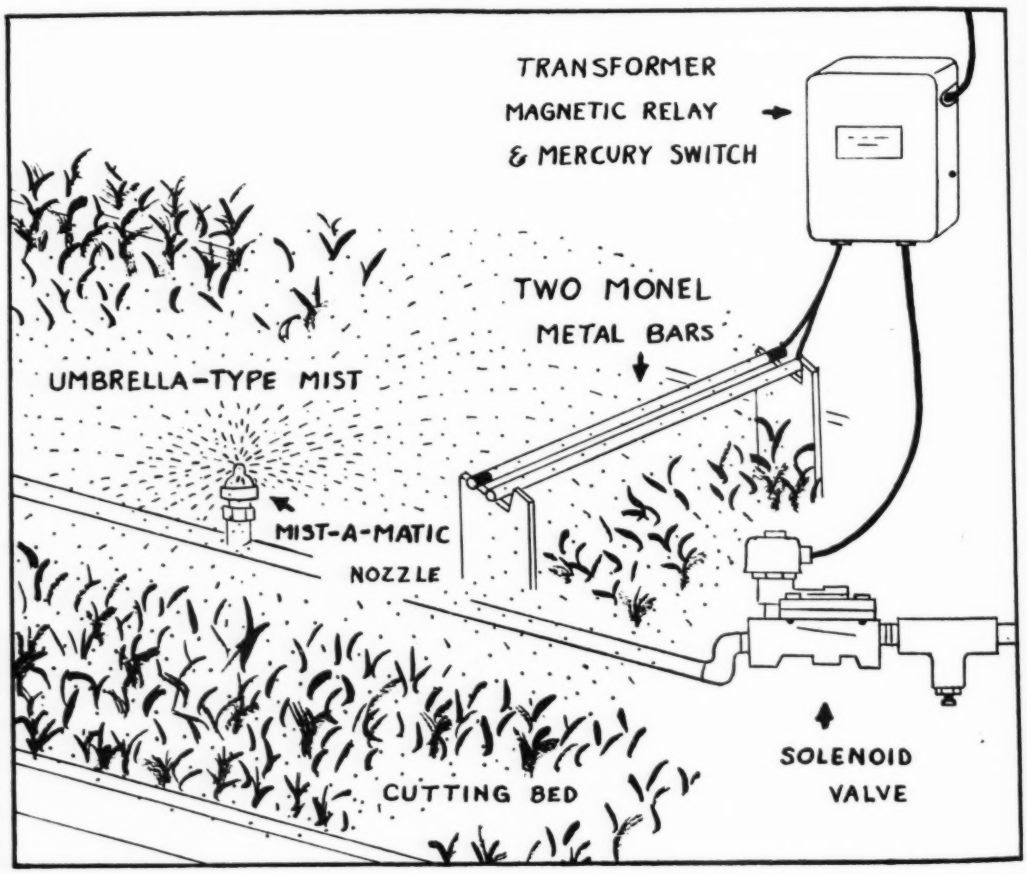


Diagram of the "Mist-A-Matic," a simplified automatic mist-propagation system.

from a plant, the leaves transpire, wilting starts, and the cutting usually dies. But if the leaves can be kept moist until the cutting forms its own roots and can nourish itself, there is a good chance of getting a plant. (2) It is known that if the medium around the cutting is kept warmer than the leaves, rooting is induced. Mist tends to cool the leaves and thus reduce evaporation. Probably a combination of both these factors is the real reason for rooting cuttings successfully by a fog line.

What medium do I use? Well, originally sharp sand was used for cuttings, but then it was evident that ericaceous plants like some organic matter, so peat moss was added. Lately a new product, "Perlite" — alone or in combination with peat moss—has been giving satisfactory results. One must remember that the medium serves to hold the cuttings upright, to retain moisture, and to furnish air, for oxygen is necessary in plant growth.

In the past few years, I have built a greenhouse, sixteen by twenty-seven feet, of plastic material instead of glass. A hot-air heater prevents the temperature from falling below 55°F; and electric cables keep the medium cozily warm, for it is said that plant hormones function best at 65°F or over. I now propagate plants the year round, and since last spring have grown several hundred lilac, a few thousand azalea, and even more holly cuttings, as well as some of other shrubs. However, in my opinion no structure is needed for summer propagation—just a mist system and some protection against the wind so that the mist will fall where it is wanted. As I recall, at the last meeting of the Plant Propagators Society, a paper was presented telling how cuttings were grown in upper New York State on a very large scale in full sunlight.

Readers may be interested to learn that the propagating range of The New York Botanical Garden has its own mist system, employing an electronic leaf. Editor

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EASTERN AZALEAS (from page 104)
difference betwen platinum and lead; but the finest forms are being propagated by progressive nurserymen, as the rooting of soft cuttings gradually becomes routine. The day may not be too distant when these decorative shrubs will be recognized everywhere for the important part they can play in gardens.

A CONCISE ENCYCLOPEDIA OF WORLD TIMBERS. ed. 2. F. H. Titmuss. 264 pages, illustrated, indexed. Philosophical Library, New York. 1959. (Published by The Technical Press, London.) $15.00.

A REVIEW

***By* William L. Stern**

Dr. Stern is Curator, Division of Woods in the Department of Botany, Museum of Natural History, Smithsonian Institution.

A BRIEF INTRODUCTION is intended to acquaint the layman with some of the facts essential to an understanding of the main part of the text. It includes sections on tree growth, anatomy of softwoods vs. hardwoods, naming of timbers, identification of timbers, and a short glossary of terms. The bulk of the text consists of descriptions of 224 woods arranged alphabetically by a common name. These descriptions may cover geographic distribution of the species, common names, general appearance of the wood (figure, grain, texture, luster), physical properties, workability, effect of preservatives and natural durability, and features useful in macroscopic identification. A number of descriptions are accompanied by low-magnification photomicrographs of the cross section of the wood. The bibliography contains works where further information may be obtained. An index to scientific and common names terminates the volume.

It is very difficult to be at all enthusiastic about author Titmuss' book, for there is little to induce elation. The introduction (incidentally it is the same as that in the 1949 edition), which includes the section on tree growth, indicates a certain lack of basic understanding of plant physiology and plant anatomy. Titmuss misleads his readers by inferring that the growth of a tree depends only on the action of the vascular cambium. Certainly meristems at the apices are highly important in this regard. A number of enigmatic statements appear in this section. For example, what is meant by, "It is by means of the cells that the tree nourishes itself . . ."? Later, the author indicates that it is the wood which conducts food in the plant. Food is conducted not by the vascular elements of wood, but by the sieve elements of the phloem.

The meaning of, "The wood parenchyma cells . . . form internal walls inside the original cells" is puzzling and certain to be deceptive. Walls are formed in cells as part of the regular process of growth and not by some means unassociated with the growth of the cell itself. The term *vessel* is not synonymous with *pore*—the latter term is one of convenience used to indicate the transverse aspect of the vessel. In another section we read, "Each individual vessel is called a *vessel member* . . . and originates from one cell in the cambial tissue." This statement is entirely contrary to accepted morphological terminology. A vessel is a tubular structure composed of a number of cells. The latter are variously designated as vessel members, vessel elements, or vessel cells. These components of the vessel are each derived from a single fusiform cambial initial.

Among the descriptions of the woods are a number of statements which leave the informed reader incredulous. "It (the timber called mora) is closely related to the Mulberry [see next entry] as it is the product of *Mora excelsa*..." The next entry is *Morus*. *Morus*, the mulberry, is a member of *Moraceae*, not *Leguminosae* as is the genus *Mora*! Further on we read, "This timber (raulí) is of the same botanical family as the true beech . . . The *Betulus* species, however, do not occur in the Southern Hemisphere, and raulí is the product of *Nothofagus procera*." To what genus author Titmuss refers when he mentions *Betulus* is questionable. *Betulus* is probably an adjectival form of *Betula* (*Betulaceae*). Most likely he should have cited *Fagus*.

Many of the photographs are so lacking in detail that nothing more than the pores are distinguishable (e.g., balsa, canarium, Central American cedar). In other instances it is obvious that the sections to be photographed were unequally illuminated, for one portion of the illustration is over-exposed while another portion is under-exposed (e.g., African mahogany, mansonia, Queensland maple). In all honesty it must be stated that some of the illustrations (e.g., Scots pine) should never have been printed.

Literature citations always lack the date of publication and frequently only the authors' surnames are listed. Outdated works are sometimes given in

(Continued on page 124)

The Painter Arboretum about 1870— it is now part of the John J. Tyler Arboretum.

THE JOHN J. TYLER ARBORETUM HAS AN HISTORICAL BACKGROUND

By **Dorothy Ebel Hansell**

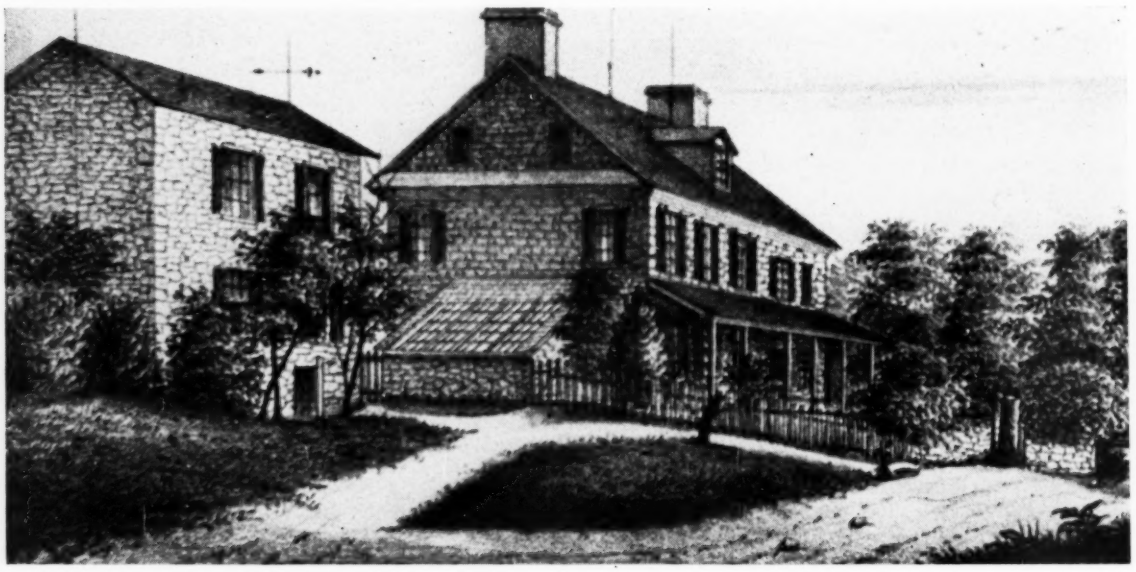
MORE THAN one hundred years ago, two brothers, Minshall and Jacob Painter, undertook a remarkable planting project. Within a period of thirty years, 1845-1875, they planted nearly a thousand different species and varieties of trees and shrubs on their property near Lima, Pennsylvania, which had been in their family for seven generations. The original grant of land was made to Thomas Minshall in 1681 by William Penn and remained in the possession of Minshalls, Painters, and Tylers until 1945.

Minshall and Jacob Painter were sons of a Quaker farmer who supplemented the family's income from farming by importing rum from the West Indies and exporting wheat to those islands. The two men had little formal education and spent their lives as farmers. But through personal observation and extensive reading, they became well versed in the natural sciences and, being in comfortable circumstances, were able to indulge in their hobbies—books and trees and minerals and insects. Collecting and studying minerals and insects, they sent some of the specimens to the Smithsonian Institute and housed others in their own museum—a sturdy stone structure with built-in, fire-proof, and air-conditioned vaults. They also studied the weather and transmitted their observations to the Smithsonian Institute.

For almost two hundred years before Minshall and Jacob Painter began the planting program on their six-hundred-and-fifty-acre farm, oaks, chestnuts, beech, maples, hickory, and tulip-trees had been cut for lumber or taken down to clear land for farming. The two Painters not only planted trees, but they let Nature reclaim some of the cleared land. Sweet gum, sour gum, and dogwood, whose seeds were probably carried in by birds; tulip-tree, red maple, and ash, whose winged seeds were brought in by the wind, appeared again on the farm fields of what is now the John J. Tyler Arboretum.

It was bequeathed to trustees in 1945 by Mrs. John J. Tyler, who carried out her late husband's wishes that the land become an arboretum for the use of the public. Mr. Tyler was the son of Minshall and Jacob Painter's sister, Ann, and Mrs. Tyler was the granddaughter of their sister, Sarah.

When the trustees persuaded Dr.



The old Minshall-Painter homestead in the time of the Painters.

Looking upword into a towering Canadian hemlock, *Tsuga canadensis*, one of the original trees planted by the Painter brothers.

John C. Wister to assume directorship of the John J. Tyler Arboretum in 1946, he was confronted with a jungle —a thickly crowded mass of trees and shrubs so entangled with briars and wild grape, honeysuckle and poison-ivy that he could hardly force his way through. From the time of Jacob Painter's death in 1876, much of the property had been neglected, except for tenant farming and firewood cutting.

This is the bole of the gingko, *G. biloba*, that was planted by the Painters.

The giant sequoia, *Sequoiadendron giganteum*, is one of the prized trees in the Tyler Arboretum.

Dr. Wister's No. 1 problem was to get rid of the vines in the woods—and this remains a continuing and costly battle. Gradually areas are being reclaimed, and trails are being opened with the aid of Boy Scout troops. At present, some twenty miles of trails wind through beautiful woodlands and fields. These trails are important, too, for access in fighting fires.

It was also necessary to spray some of the field and other areas to free them from honeysuckle and poison-ivy. This

All that is left of the huge osage-orange, *Maclura pomifera*, which was full of fruit when Hurricane Hazel blew it down in 1954. The twisted trunk has been kept because of its size and because children love it.

This magnificent tree, *Cryptomeria japonica*, was planted by Mrs. John Tyler about 1930.

operation in a small section of the old Painter arboretum, where a wild flower garden is being made, resulted in a one hundred per cent kill. However, within three years a host of wild flowers — asters, boneset, Solomon's seal and Solomon's plume, dentaria, Jack-in-the-pulpit, May-apple, bloodroot, and others— have sprung up.

Most of Dr. Wister's attention cen-

Ivy trails over the "knees" of bald cypress. Ivy and also myrtle, *Vinca minor*, have been growing luxuriantly in the Arboretum for over a hundred years.

The front of the old Painter mansion is now used as a museum and meeting place.

The trunks of aged box, their bare branches green with algae, furnish a unique screen.

The trunk of the magnificent European beech (*Fagus sylvatica*) in the "old Painter arboretum."

tered in the beginning on the restoration of the five-acre "old Painter arboretum," that contained Minshall's and Jacob's closely planted collection of trees and shrubs. This meant removing dead and injured specimens and carefully pruning the rest. Today there are about one hundred and twenty-five species of those originally planted by the brothers. Among the survivors are a many-trunked Chinese gingko, a huge cedar of Lebanon, a magnificent European beech, a pond cypress, a towering bald cypress with many "knees," a giant mossy-cup oak, a superb specimen of American holly, the rare Japanese cryptomeria, and an Oriental spruce, now a majestic one-hundred-foot-high tree. Perhaps the most notable of all the trees the Painters planted is the giant sequoia, *Sequoiadendron giganteum*. Over a hundred years old, this specimen has a circumference of nine feet and a height of fifty feet or so —a long way to grow before reaching the height of two hundred and fifty feet which *S. giganteum* attains in the Sierra Nevada Mountains of California. Six each of the giant sequoia and of the cedar of Lebanon were planted here between 1856 and 1864, but only one of each stands—fine specimens to which anyone could point with pride.

Still flourishing are the cottonwood, *Populus deltoides*, though it is seldom that this tree lives so long, and a large coliseum maple, *Acer cappadocicum*, that the Painters bought from the Josiah Hoopes Nursery in West Chester, Pennsylvania, in 1860. The coliseum maple is a native of the west shores of the Caspian Sea, and one may wonder how it found its way to Hoopes nursery. Hoopes was an enterprising young man, keenly interested in unusual plants, and he imported many from France. The Painters were among his

The old, ivy-covered springhouse.

A fine specimen of *Parrotia persica*. This tree, a native of Persia, is infrequently planted, although it is hardy in the North and has brilliant fall foliage.

The section that is being planted with rhododendrons, azaleas, and mountain-laurel, as it looked in September 1959.

The great barn has been strengthened, but the exterior walls remain untouched. The upper floor is used for lectures and flower shows; the lower floor accommodates trucks, tractors, and other equipment, a tool room and workshop.

Another view of the great barn.

best customers and bought many trees and shrubs from him—among the latter, the Chinese *Mahonia bealei* in 1860. It is now a specimen fully ten feet across and seven feet high. In the winter of 1958-59, it was buried beneath a heavy mantle of snow, but came through this ordeal well.

From the specimen of *Paulownia tomentosa* that the Painter brothers planted and Hurricane Hazel in October 1954 ruined, a young tree is now developing. The largest specimen of the willow oak was also destroyed by Hurricane Hazel, which played havoc with the Arboretum, but others are coming along. There are many young trees of the Virginia pine that the two men originally planted. There is a beautiful *Oxydendrum arboreum* growing out of the large stump of one of the early specimens; also an old specimen of

Franklinia (Gordonia) alatamaha. This enchanting tree, discovered in Georgia in 1765 and later cultivated in Bartram's garden in Philadelphia, has not been seen in the wild since 1790.

Minshall and Jacob Painter also set out quite a few magnolias, including the fragrant *M. denudata* from China

Left. A path along one of the terraces in the fragrant garden for the blind.

Below. A Braille label in the garden for the blind.

This particular serpentine barren is called "Pink Hill" because of its lovely color in spring, when it is carpeted with the blooms of the ground-pink, *Phlox subulata*.

and *M. macrophylla* and *M. grandiflora* from the South: *M. tripetala* and *M. virginiana*, native to the locality, are abundantly represented. *M. grandiflora* did not survive and was replaced recently by the clone 'Bogue'. The latter has been propagated by Harry Deverman of Clifton, New Jersey, from a specimen of *M. grandiflora* that was sent from Florida in 1920 to a Montclair, New Jersey, garden. It survived the severe winter of 1934, so Mr. Deverman decided to propagate it, which he has accomplished by grafts.

Many new plantings have been made in the past fifteen years—thirty-eight different kinds of crab-apples, twenty-four different flowering cherries, fifty varieties of lilacs. An extensive planting of rhododendrons and azaleas, species and garden hybrids, is under way and will be a most attractive section when completed. The collection includes many of the hybrids bred by Joseph Gable and G. G. Nearing, catawbiense hybrids, maximum hybrids, and Dexter hybrids. Later on, some of the Glenn Dale azaleas will be added.

Twenty-five acres have been set aside, near the giant sequoia, for spruces, pines, firs, hemlocks, cedars, junipers, and so on. Four or more specimens each of one hundred different species and varieties of cone-bearing trees are planned to be acquired for the pinetum over a period of some years. Three specimens of a kind will be planted in a group and a single specimen a short distance away. In some groups as, for instance, the Douglas-fir, there may be as many as eight or nine specimens. This planting has been partially carried out.

Five hundred herbaceous and tree peonies in two hundred varieties; about a hundred varieties each of iris and daylilies; more than twenty thousand daffodils of several hundred varieties; and thousands of scillas and grape-hyacinths have been planted in recent years for visitors to study or just enjoy, as they may desire. (The drifts of snowdrops and winter-aconite are from the old Painter plantings.)

The fragrant garden for the blind is a feature near the entrance to the John J. Tyler Arboretum. Its four terraces are planted with shrubs, with herbaceous plants for their spring, summer, or autumn flowers, with culinary herbs, and small bulbs. The local garden club, The Country Gardeners, cares for the planting on the top wall; the Philadelphia Unit of the Herb Society of America, the herb wall; and the West Chester Garden Club, the perennial wall. A hand-rail guides the blind visitors, and labels are written in Braille.

Dr. George Taylor, Director of the Royal Botanic Gardens at Kew, near London, England, visited the Arboretum in October 1958. The dogwoods in their glowing autumnal colors were his delight. He also was charmed with the stretch of woods along Rocky Run where tall oaks and tulip-trees make a canopy for maples, hickories, sweet gum, and beeches, which in turn shelter dogwoods, spice-bush, witch-hazel, cle-

(Continued on page 114)

Quiet pervades this woodland in the Tyler Arboretum.

A Country Housewife's Garden

By Gertrude B. Foster

Mrs. Foster is Editor of
The Herb Grower Magazine

"My hands smell of the
Herblike scent,
Telling what garden
Way I went."
"Marigolds" by Louise Driscoll

IF I HAD approached you with hands onion-scented, would you surmise that I had come from a garden in miniature, whose flowers rival in beauty any of the spring-flowering bulbs? Each of the twenty-five segments of my large rectangular herb garden is a little garden in itself. Some beds are filled with plants of similar scent: lemon-scented balm, lemon basil, lemon bergamot, and lemon thyme; or fruit-scented pineapple sage, apple mint, and the variegated apple mint, known as pineapple mint.

Some plants have the capacity to nullify the scent of others. Parsley or rue nibbled after eating garlic will sweeten the breath. Mustard leaves, if rubbed on hands after they have been working with the onion family, will act as a deodorant.

Unless you knew them well, you would not believe that the ornamental onions could have flowers of such delicate fragrance, so different from the characteristic odor of the leaves. The allium bed is one of the most colorful spots in my herb garden from May until September. It is edged with low-growing *Allium senescens* var. *glaucum* with curly, blue-green foliage and ball-shaped heads of lavender flowers in late summer. *Allium ostrowskianum*, six inches tall and covered with conspicuous rosy heads, is the first species to bloom. Then the chives, in several shades and sizes, begin their show. *Allium schoenoprasum* has a dusty rose form that blends well with garden pinks. Var. *sibiricum* produces blossoms taller than the leaves, which measure from eighteen to twenty-four inches, and is a much lustier plant in appearance than the typical variety.

Allium moly, which looks so much like a species tulip in leaf, furnishes a spot of yellow on the shady side of the bed when in bloom in early June. By the time its loose-flowered heads have gone to seed, the taller *Allium senescens*, which is planted towards the middle of the bed, is starting its long succession of blooms.

The ends of the bed are reserved for two special alliums with thin grass-like leaves and lovely bearded blossoms. They are *Allium flavum*, that has showy bracts below its blossoms of delicate yellow and grows twelve to eighteen inches tall; and *Allium pulchellum* that has two narrow bracts two to four times as long as the deep purple, tumbled umbel. The leaves clasp the narrow scapes; this gives the blossoms an airy look above the slim foliage. Both species bloom in July in my garden. Another wiry-leaved *Allium, called A. caeruleum*, and also listed as *A. azureum*, proved a winter fatality, to my regret. It grew almost three feet tall and produced a few steel-blue balls of flowers the first year; perhaps the situation was not to its liking. I was sorry to lose *A. caeruleum*, because few bulb genera include flowers in the pink-purple range and also in yellow and in true blue, and I'd like to have all the ornamental alliums.

The handsomest allium in the bed is *A. tuberosum*, sometimes called garlic-chives. Its starry white florets in flat umbels have a truly sweet perfume. If the leaves are not disturbed, there is no hint of salad bowl when you sniff the flowers. The leaves may be used in place of chives in seasoning, if only a slight garlic flavor is desirable. The foliage is flat rather than round, eighteen inches to two feet tall in chive-like clumps.

Lack of space prevented my putting the three much-used culinary alliums in the bed. Rocambole, *A. scorodoprasum*, with its bird-like scapes which unwind from a complete circle and remind one of a delicate green French horn or, when the pointed buds are not yet erect, of long-beaked birds standing on one leg, produces bulbils instead of flowers at the top.

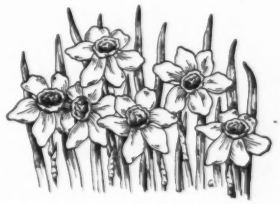
Each curious cluster of minute, strongly garlic-flavored bulbils is wrapped with a long-pointed spathe similar to that of the leek but not so large. New plants can be grown from the tiny cloves, or they can be stored in a brown-paper bag thoughout the winter to press into service when a "little garlic" taste is wanted. The multiplier onion, *A. viviparum*, is too large for the ornamental bed; its hollow stalks are often an inch in diameter and the conical onion-like segments, which appear where flowers should, are as large as onion sets.

Shallots, *A. ascalonicum*, have a row to themselves in the vegetable garden. They are the choicest of all onion seasonings, much used in French cookery. The brown-skinned bulbs are divided into loose sections, somewhat like those of garlic, and each segment will produce a new plant. When the foliage dies down in June or July, the bulbs are ready to be dug. They will keep in dry storage all winter, but some of the harvest should be replanted in the fall for next year's crop.

All the alliums flourish in rich soil. The ornamental species, especially *Allium senescens* and its varieties, will live for many years without enrichment, even on a rock garden site where the soil is thin. The taller, typical *A. senescens* self-sows freely and thus reaches new earth through scattering its seedlings. A bed devoted to *Allium* species must receive a topdressing of well-rotted manure and compost or shredded bark and commercial fertilizer every spring. Bulbous plants tend to push up towards the surface during the end-of-winter thaws, so extra covering with new soil or mulch helps to protect the roots.

There are many more interesting and beautiful alliums which I hope to collect through the years. Many of my favorites came to me from Helen M. Fox, horticulturist and author. I remember walking through the rock garden on her former estate, "Foxden," and asking about the bearded *A. flavum* and *A. pulchellum* then in bloom. Mrs. Fox pioneered in this field, as she did with lilies years ago. Her book, *The Years in My Herb Garden*, describes the most attractive species. When the choicest of plants were transferred from "Foxden" to Mrs. Fox's lovely new garden at Mt. Kisco, the ornamental alliums were not left behind.

For botanical identification of *Allium*



species, consult the four-part monograph, "The cultivated alliums," by Dr. Harold E. Moore, Jr., (*Baileya* 2: 103-113, 117-123; 3: 137-149, 156-167). The differences between the bulbous and rhizomatous types are discussed. The latter includes *A. senescens,* whose leaves remain green during flowering and after the seed heads are cut back.

TYLER ARBORETUM (from page 112)

thra, azaleas, and viburnums.

To see that well-loved old plants are properly cared for and choice plants added to augment the collections—this is the motivating spirit of Dr. Wister, Director, Miss Gertrude Smith, the Assistant Director, and the Trustees of the John J. Tyler Arboretum, in keeping with a fond motto of Minshall and Jacob Painter—"The Genius of Progress, onward and upward."

SPACE GARDEN (from page 91)

gardening this figure will be considerably reduced.

Alga growing is quite simple. A small amount of chlorella, seeded in a suitably aerated glass water container and fertilized with a 10N-5P-1K mixture, will rapidly increase in growth and attain a cell density of two to three grams per liter in a week.

In addition to nitrogen, phosphorus, and potassium, chlorella requires magnesium in amounts equal to that of potassium. The other elements, with the exception of iron, are required only in the trace amounts found in tap water. Chelated iron at the rate of five ppm is usually required, since the pH of the suspension tends to go basic and ordinary iron solutions precipitate above pH 7.0.

The algae are in a sense shade-loving plants. A thin suspension requires about 500 foot candles of light. As the suspension increases in density, the light intensity may be increased up to 4-5000 f.c. Chlorella grows well under fluorescent light or sunlight. The food value of chlorella is quite high. A rapidly growing suspension has a protein value of about seventy per cent on a dry-weight basis. As the suspension becomes dense and ages, the fat and carbohydrate contents of chlorella increase, while the protein value decreases.

It is not difficult to grow chlorella with a thirty per cent protein, forty per cent fat, twenty per cent carbohydrate, five per cent fiber, and five per cent ash content. This ratio is considered ideal from a balanced diet standpoint. The algae, however, are probably deficient in the sulfur-bearing amino acids.

Dried chlorella has an aroma like newly harvested alfalfa meal. In cooking, not all of this aroma is removed. However, astronautical crews will be supplied with a variety of recipes for cooking algae and the necessary condiments to vary the algal taste.

Actually, it is not expected that algae will be the sole source of food for space crews but merely the food staple, with a decreasing amount of supplement as the length of the trip increases.

Orbiting space stations, lunar observations, and the like will have more elaborate gardens in which, in addition to algae, a variety of broad-leaved plants will be grown for food and oxygen production.

Some of the plants under consideration are leaf lettuce, cabbage, collards, mustard, chard, spinach, turnips, carrots and beets. These plants have been selected because they are compact and have relatively large leaf areas for efficient photosynthesis, mature in a relatively short period of time, and are highly edible.

While the broad-leaved plants are generally low in protein, this problem can be overcome by using a high-protein alga as part of the diet.

The over-all problem of the "broad-leaf" garden is much more complex than the alga garden. The algae grow in a liquid medium and can utilize either solar radiation or fluorescent illumination, but many of the broad-leaved plants will not survive in fluorescent illumination. The beet is one of these.

Supplying moisture to broad-leaved plants becomes a major problem in weightless or zero-gravity conditions. Orientation of the root and shoot does not seem to be related to a gravitational field, however. The shoot can be oriented by blue light, while root distribution is controlled by oxygen gradients and soil density.

The problems of maintaining man and plant in outer space are numerous and complex. Difficult as they are, we shall see both successfully completing their space missions before the end of the next decade.

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BOOK REVIEWS

CEYLON TREES. T. B. Worthington. Illustrated, indexed. Colombo Apothecaries' Co., Ltd., Colombo, Ceylon, 1959. Rs 40 = $8.50.

Ceylon Trees is a collection of 229 black and white photographs of branches, flowers, and fruits of many of the trees of Ceylon. Added are local names in several dialects and languages and data on the origin, characteristics, and uses of the plants. The photographs are of excellent quality, and all are of the same magnification, showing the foliage approximately one third of natural size. The frontispiece, a map of Ceylon, has been divided into three environmental zones —arid, dry, and wet — and local distributions are given in these terms as well as in terms of specific provinces and locations. An index is supplied both to the local and generic names of the plants.

The author has followed the sequence of Trimen's *Flora of Ceylon*. Species are arranged according to plant family, and no keys or descriptive groupings are supplied for the amateur. The value of this book, therefore, is for the professional botanist who may lack herbarium material or other illustrative material of the species listed in Trimen's Flora. The author, however, knows his plants well and has supplied critical information on leaves when they are young and mature, on variations in bark appearance with the age of the plant, and on colors and odors of flowers and fruit. Such characteristics are difficult to obtain in existing floras of Ceylon.

A perusal of *Ceylon Trees* reveals many species commonly cultivated in sub-tropical Florida and tropical America. By his descriptions Mr. Worthington indicates that there are still additional species in Ceylon which may profitably be tried for their ornamental value in the New World.

RICHARD A. HOWARD, *Director*
The Arnold Arboretum
Cambridge, Mass.

FAIRCHILD'S DICTIONARY OF TEXTILES. Stephen S. Marks (Edited by). 627 pages. Fairchild Publications, Inc., New York, N.Y. 1959. $25.00.

"Dictionaries are like watches; the worst is better than none, and the best cannot be expected to go quite true"

SAMUEL JOHNSON

It is either the soft–or very hard-headed who edit dictionaries. The more mundane would be staggered by the complicated task. Words, like everything else, are not immutable. Their meanings grow and change with usage. Nowhere is this more true than in the shifting world of mercantile fashion; for here words are chiefly coined as selling gimmicks rather than exact descriptions. "Meteor crepe" has nothing to do with our space age but was a satin-back crepe popular in the days before World War I. "Madras" is now any number of plain-woven cottons manufactured many thousands of miles from the Indian province of Madras.

The recently published Fairchild's *Dictionary of Textiles* has been well described some two centuries ago by Dr. Johnson. Compiled by members of the staff of the celebrated Fairchild trade paper publications it shows, not surprisingly, a wide range of definitions from excellent to inaccurate. The intrepid editor, Stephen Marks, has in his introduction modestly marked the pitfalls of his editorship. Unfortunately he has not outlined a positive approach to the definition of fabrics. Both Mr. Marks and many of his predecessors have often been content with the description of outward appearance. The more valid characterization of construction, manufacture, and use is frequently bypassed. Anyone in search of definitions must consult several dictionaries for these answers. However, dictionaries of fabrics have been published, and many more will be published to add to our foggy knowledge.

Today the terminology of the fabric business and other fashion industries is a great grab bag of prejudice, misinformation, loose interpretation, and just plain ignorance. Any attempt to bring order from this chaos is to be welcomed. Eventually we shall be able to build a literature of exact meanings and pertinent definitions.

ROBERT RILEY
Director, Industrial Research Div.
Brooklyn Museum
Brooklyn, N. Y.

NITROGEN METABOLISM IN PLANTS. George C. Webster. 152 pages, illustrated, indexed. Row, Peterson and Company, Evanston, Illinois. 1959. $3.50.

This is an excellent pocket-size paperback book, with chapters on amino acid metabolism, biosynthesis of amides and peptides, protein and nucleic acid metabolism, and nitrogen metabolism in the intact plant. Advances with other organisms, from bacteria to animals, are given ample due, although higher plants never leave the center of the stage. This unpretentious book can be heartily recommended to botanists staggering under the burden of costly gigantic "handbooks" of plant physiology and biochemistry doomed to speedy obsolescence and penetrable only with concentrated prolonged study.

The reviewer hopes that this venture will be well supported, so that more of these handy (not "hand"!) books will be published and in large enough printings to permit low cost.

S. H. HUTNER
Haskins Laboratories
New York, N. Y.

PHOTOBIOLOGY. Robert W. Newburgh (Edited by). 90 pages, illustrated. Oregon State College, Corvallis. 1958. $2.50.

Photobiology is a compilation of the papers presented at the 1958 Biology Colloquium held at Oregon State College. The speakers were from Pacific Coast colleges and universities. The subjects covered such biologically important questions as plant growth responses to light, photoperiodism in plants and animals, visual pigments in animals, chlorophyll, and photosynthesis.

Each topic was ably covered by one or more speakers. The subject of a periodic response of plants and animals to an external stimulus, which has received relatively little attention in the past, was discussed by Drs. Went, Farner, and to some extent by Hamner. As pointed out in the papers, it may be that the study of the photoperiodism is fundamentally a study of a natural "internal clock." Those who do research in photoperiodic response need to consider this point more seriously. The energy transfer of sunlight to the reduced carbon atom was the subject of Dr. Bassham's paper. The many different types of visual pigments in animals were discussed and a new classification of them proposed by Dr. Crescitelli.

The papers are well presented and illustrated. As each paper is a different topic, any one of them can be read without reference to the others.

PHILIP H. PLAISTED
Boyce Thompson Institute
for Plant Research, Inc.
Yonkers, New York

AN INTRODUCTION TO BACTERIAL PHYSIOLOGY. Second Edition. Evelyn L. Oginsky and Wayne W. Umbreit. 443 pages, illustrated, indexed. W. H. Freeman and Company, San Francisco. 1959. $7.50.

The authors take, as their basic premise, that virtually every bacteriologist is a bacterial physiologist to some degree and that all should be acquainted with the field. With these thoughts in mind, they have constructed a text for advanced students designed to illustrate their thesis. This has been accomplished admirably. The book examines the manifold activities of bacterial populations and cells in a logical sequence of nineteen chapters divided into six sections. The text is well written, edited, and illustrated.

The reviewer has never been a fan of the tendency to indulge in fanciful illustrations — a feature of the biological texts put out by Freeman and Co. The section on the biochemical pathways of intermediary metabolism is rather trite and repeats similar sections in a score of advanced texts on biochemistry and physiology.

All in all, the book is a valuable text for a beginning course in bacterial physiology. Its use in this connection will be extensive. It is not, nor does it pretend to be, a substitute for the laboratory and the field—a fact that instructors should keep firmly in mind.

RICHARD M. KLEIN

CYTOLOGY AND CYTOGENETICS. Carl P. Swanson. 596 pages, illustrated, indexed. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 1957. $13.35.

Dr. Swanson has written a most useful text which effectively summarizes many of the recent developments in the field. The emphasis is on the chromosome. The book presents lucid expositions of the various theories of chromosome structure and behavior. The last quarter of the book is of particular interest, as it deals with the implications of cytology in evolution.

There are forty-six pages listing references. A significant part of these are to works published within the previous ten years, thus attesting to the rapidity with which the field has grown. Therefore, it is perhaps inevitable that some of the more traditional and descriptive aspects, viz., gametogenesis and embryo sac development, receive little attention.

Dr. Swanson is the William D. Gill Professor in Biology in the Johns Hopkins University.

THEODORE M. BARKLEY

METHODS FOR STUDYING SOIL MICROFLORA-PLANT DISEASE RELATIONSHIPS. Leander F. Johnson, Elroy A. Curl, John H. Bond, Henry A. Fribourg. 178 pages, illustrated, indexed. Burgess Publishing Co., Minneapolis. 1959. $3.50.

This little, modest, sturdy, loose-leaf-bound book, notwithstanding the limitation expressed by its title, should be useful to botanists newly aware that the bacterial population of a crumb of soil comprises a fantastically numerous and varied collection of biochemical specialists, some attacking re-

(Continued on page 122)

NEWS, NOTES and COMMENTS

Sir Oliver and Lady Leese were guests of The New York Botanical Garden on February 9, 1960. They have a remarkably extensive collection of cacti and succulents in their nurseries at Worfield in Shropshire, England. They are also co-authors of the fascinating book, *Desert Plants—Cacti and Succulents, in the Wild and in Cultivation,* published in 1959 by W. H. & L. Collingridge, Ltd., England, and by Transatlantic Arts, Inc., 1960, in the United States.

Mrs. William C. Steere, wife of the Director of The New York Botanical Garden, was hostess at the luncheon in honor of Sir Oliver and Lady Leese. T. H. Everett, Assistant Director (Horticulture) and Curator of Education, was the master of ceremonies. He recalled his first experience with cacti and succulents, when he was assigned to the cactus and succulent house during his training at the Royal Botanic Gardens, Kew. He had looked upon these plants as dull and uninteresting — they did not grow much, they didn't flower often. But in the thirteen months he had charge of the cactus and succulent house, he learned that they do grow and change considerably, that they are different from season to season, and that some bear very beautiful flowers.

Sir Oliver related how he became interested in these desert plants, when he commanded thirty corps in the campaign in North Africa under General Montgomery. Later, he succeeded General Montgomery in command of the Eighth Army in Italy. In the closing days of the Burma campaign, Sir Oliver was Commander-in-Chief of the Allied Land Forces.

Upon retirement from the army in 1946, Sir Oliver engaged in growing mushrooms commercially at his Shropshire farm. Cacti and succulents were more intriguing, however, and though the collection was originally started as a hobby, the hobby soon developed into a consuming interest — in which Lady Leese shares enthusiastically—and a profitable nursery business.

Sir Oliver and Lady Leese have studied these plants in their native habitats in Africa and America, as well as in botanic gardens and nurseries all over the world.

Thank you, Grace Meleny. Those of us who are acquainted with the daily activity in the Museum and Administration Building of The New York Botanical Garden have noted the regular arrival of someone new. Who is she who marches through the halls like clockwork, twice weekly, with arms full of papers, boxes of index cards, typewriter, handbag, and sundry paraphernalia, and heads for the last inconspicuous, unmarked door on the right wing of the main floor?

Her name is Grace Meleney. She has a B. A. from Mt. Holyoke College, an M.A. in zoology from Columbia University, and has recently retired as a successful and beloved teacher from the biology department of Theodore Roosevelt High School in the Bronx, New York City. Miss Meleney's interests and hobbies are many, varied, and commendable. For most of her life she has been a bird bander—an avocation facilitated by a dozen ingeniously fitted traps in the shrubs and trees of her garden at White Plains, New York — with many "repeaters" caught, banded, released, and catalogued. Perhaps it is this feeling for the accurate, the pigeon-holing, and the "statisticking," coupled with an inherent love for all that is in nature, including children, that moved Miss Meleny to volunteer her services not only to the Garden, but also to UNICEF.

As the owner of a cottage on Martha's Vineyard, Grace Meleney has observed the invertebrate life of the seashore and also discovered some of the same Cretaceous plant fossils that the late Dr. Arthur Hollick had so thoroughly studied and described earlier in the century. Upon her first visit to the paleobotany collection of The New York Botanical Garden, Miss Meleney saw her great chance of contributing actively to scientific endeavor. She has for the past eight months become the most faithful volunteer in cataloguing the fossil plant collection of some twenty thousand specimens. If there should be a lull in bird banding on weekends, Miss Meleney is fortified with homework from the Garden.

Her former students are elated when she returns occasionally for substitute teaching. Who says the age of retirement is one of decline?

Thank you, Grace Meleney, for your generous contribution of time and effort. Palaeobotany is well served with every facet added to its growing edifice.

HERMAN F. BECKER

Dr. Eugene Jablonski has been engaged for the past several months in research on the *Euphorbiaceae* at The New York Botanical Garden, enjoying in his retirement the pursuit of botany in which he majored at the University of Breslau. World War I enveloped Europe shortly after Dr. Jablonski received his degree. He enlisted in the Austrian army and saw service in Russia.

At the end of the war, no one seemed particularly interested in a botanist; but, as Dr. Jablonski had minored in geology at the University, he was successful in obtaining employment as a geologist with Socony Vacuum and came to this country in 1925. In Socony's foreign service, Dr. Jablonski traveled extensively. At the time of his retirement in 1957, he was chief geologist.

Dr. Jablonski has been appointed Honorary Curator of Tropical Botany in appreciation of his annotating the Garden's type specimens of the *Euphorbiacea.*

Dr. Jablonski's earlier research on the *Euphorbiaceae–Brideliae* was published in *Der Pflanzenreich.*

Activities of the Director and Staff. Dr. William C. Steere, Director, has attended the following meetings during the past several months: Selection Committee of the Woodrow Wilson National Fellowship at Princeton, N. J.; Committee on Institutional Grants of the American Cancer Society, at New York City; Board of Directors of the Horticultural Society of New York at New York City; Committee on plans for the meeting of the American Association for the Advancement of Science in New York City this coming winter, at Washington, D.C. Dr. Steere talked before the Kiwanis Club of the Bronx and the Rotary Club of the Bronx on The New York Botanical Garden. He was accompanied, at these luncheon meetings, by Robert F. Kolkebeck, Assistant Director (Administration) and Business Manager; Dr. H. W. Rickett, Acting Assistant Director (Botany) and Bibliographer; T. H. Everett, Assistant Director (Horticulture) and Curator of Education; and Henry

Sir Oliver and Lady Leese with Robert F. Kolkebeck, Assistant Director (Administration) and Business Manager of The New York Botanical Garden, between them, enjoy their conversation with John Devlin of *The New York Times.* At the left is John R. Whiting, Publisher of *The Flower Grower Magazine.*

de la Montagne, Assistant Director Emeritus and Secretary of The New York Botanical Garden.

Dr. Richard M. Klein, Alfred H. Caspary Curator, participated in seminars at Yale University and at Union Carbide Research Institute, on "Effects of Radiation on Plant Growth."

The Development Section of the American Zoological Society, the Society for the Study of Development and Growth, and the new Developmental Section of the Botanical Society of America are arranging for a symposium on "Activation of the Metabolic System in Development" during the meetings of the American Institute of Biological Sciences at Stillwater, Oklahoma, in August 1960. Dr. Klein represents the Botanical Society on the Symposium Committee.

Dr. Marjorie Anchel attended the meetings of the American Society of Biochemistry in Chicago, held in conjunction with the meetings of the Federation of American Societies for Experimental Biology.

Dr. Nalini Valanju is doing research under Dr. Anchel in the Research Laboratory on a National Science Foundation grant.

Dr. Arthur Cronquist, Curator, attended an indoctrination meeting in Washington, D.C., for directors of 1960 Summer Institutes for high school students. The meeting was sponsored by Science Services for the National Science Foundation.

Dr. P. P. Pirone, Plant Pathologist, addressed the Management Section of the American Gas Association in Pittsburgh, Pa.

Dr. Clark T. Rogerson, Curator of Cryptogamic Botany, engaged in research at the State Museum in Albany, N. Y., for several days.

Dr. Herman F. Becker, Visiting Research Associate, completed a major paper on the Mormon Creek flora under his grant for research on the Ruby flora of Montana from the National Science Foundation.

Dr. Caroline K. Allen, Visiting Research Associate, made successful visits, between October 1959 and February 1960, to the herbariums at Harvard University, the National Museum, the University of Michigan, the Chicago Museum, and the Missouri Botanical Garden, to select supplementary specimens, not represented in the Herbarium of The New York Botanical Garden, for loan; and also for type material. These visits were made by Dr. Allen in pursuit of her research on "American *Lauraceae*: Taxonomy and Geographical Distribution" under a grant from the National Science Foundation.

Dorothy Ebel Hansell, Editor of *The Garden Journal*, attended the preview of the garden show of the Long Island Nurserymen's Association at Westbury and the spring flower shows in Philadelphia and Boston, and visited the Arnold Arboretum in Jamaica Plain and Cambridge, Mass.

1960 Summer Institute for High School Students at The New York Botanical Garden will start on July 11 and continue through August 12. Dr. Arthur Cronquist, Curator, will direct the Institute, and George Schwarz, biology teacher at the Forest Hills Senior High School, will be the assistant director. Mr. Schwarz also teaches in New York University. Members of the Garden's staff will serve as instructors, and there will be guest instructors whose names will be announced later.

The Eastern Trial Grounds of the American Dahlia Society is to be located at The New York Botanical Garden. An agreement between the Garden and the Society was arranged by T. H. Everett, Assistant Director (Horticulture), with the approval of the Director, and the officers of the Society.

Bertrand E. Pitt, President of the American Dahlia Society, stated that the Society is happy to have such an accessible location for its Eastern Trial Garden. The trial garden has had three locations in its forty-five years. For the first thirty years, it was located at the Connecticut State Agricultural College, now the University of Connecticut. For about the next five years it was at the New Jersey Experiment Station at Rutgers University, New Brunswick. For the past ten years, it has been located at the New York State Agricultural and Technical Institute at Farmingdale. During these years, many new dahlia varieties have been certified as being worthy of introduction to the American public. It is at these trial gardens that teams of expert judges score each variety on the official A.D.S. score card several times each season. If the average score of the judges rates a variety at eighty-five points or over, then an A.D.S. Certificate of Merit is awarded to the originator; the dahlia is listed in the yearly consolidated listing of the eight trial gardens; and its name and description are published in the November issue of the *American Society Bulletin*. A report of the Certificate winners will be made available to the Editor of *The Garden Journal*.

Entries in the Eastern Trial Garden are not limited to members of the American Dahlia Society. Anyone, including members of The New York Botanical Garden may send three roots, or three greenhouse-rooted plants to Louis P. Politi, Horticulturist at The New York Botanical Garden, Bronx Park, New York 58, N. Y., before May 15. The entrance fee is $4.00 per variety.

Entry blanks may be had from Mr. Politi, or from Henry Olsen, Chairman of the Trial Garden Committee of the American Dahlia Society, 48 Clement Avenue, Elmont, Long Island.

Lynn B. Dudley, Editor of the *American Dahlia Society Bulletin*, who has taken a lively interest in the "dahlia crescent" at the Garden during the years of 1958 and 1959 and contributed dahlia species as well as varieties to the Garden's collection, was instrumental in bringing together the Society and the Garden on this new program.

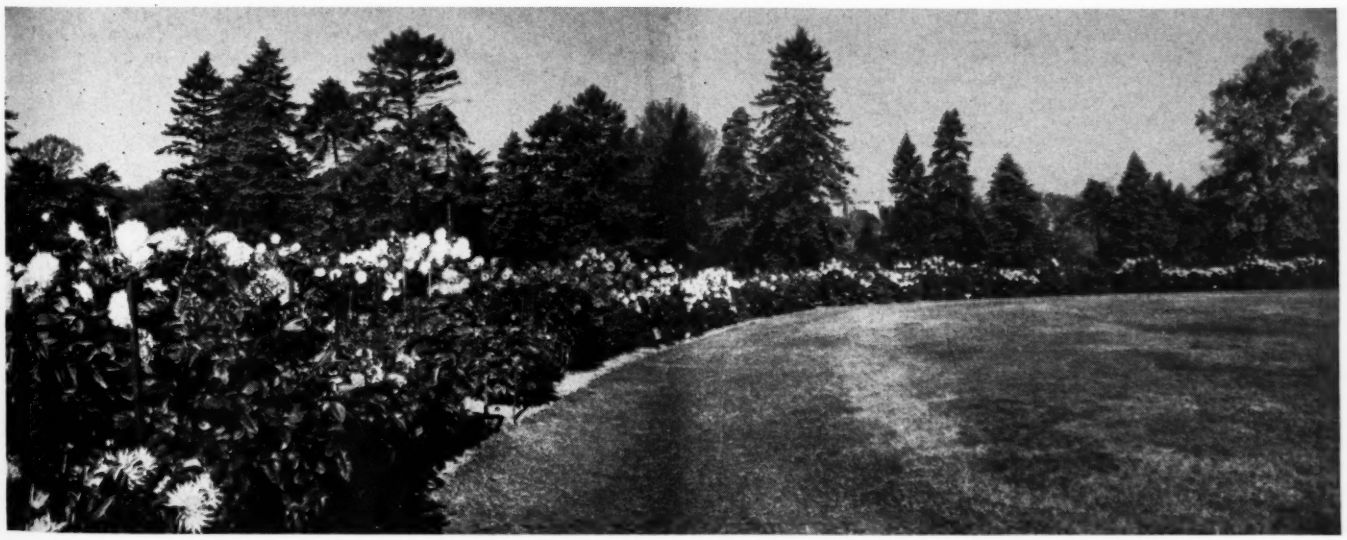
Visitors are welcome to view the Eastern Trial Garden, as well as the named, older varieties that are planted separately. The dahlias will be in bloom from about the last of August until frost.

Edward B. Lloyd of Montclair, New Jersey, a member of The New York Botanical Garden, has been appointed to the Board of Consultants of the 1964 New York World's Fair. Mr. Lloyd, who has been in the highway construction and maintenance field since 1913, will serve with the group concerned with parkways through the Fair grounds, the floricultural displays, and indoor exhibits.

A past president of the American Dahlia Society and for many years chairman of its trial gardens, Mr. Lloyd is now serving as the chairman of the Society's golden anniversary exhibit at the 1964 World's Fair.

Paul F. Frese has been appointed Director of Public Information and Education at Sterling Forest Gardens near Tuxedo Park, New York. Mr. Frese was editor of publications at the Brooklyn Botanic Garden and formerly editor of *Flower Grower*, and is well known as a writer and lecturer.

Sterling Forest Gardens have appointed Charles A. Lewis Chief Horticultural Supervisor and Martin Flayter Supervisor of Landscaping and Maintenance. Mr. Lewis



The crescent-shaped border of dahlias at The New York Botanical Garden.

has done research in snapdragons and chrysanthemums for Yoder Bros., Barberton, Ohio, and has won acclaim for his displays of chrysanthemums in the Channel Gardens of Rockefeller Center and at the International Flower Show. Mr. Flayter has landscaped many of the private estates and public parks in Orange and Rockland Counties, New York, and for twenty-four years was associated with the New York State Department of Agriculture and Markets.

Petroleum from the Air. Dr. Frits Went, in addressing a meeting of the American Association for the Advancement of Science this past winter and in his paper, "Organic Matter in the Atmosphere and its Possible Relation to Petroleum Formation," published in the February 1960 issue of *Proceedings of the National Academy of Science of the United States of America*, expressed his belief that the blue haze associated with smog in Los Angeles and other metropolitan areas consists of volatile hydrocarbons and similar substances given off by plants. Brought down from the sky by rain and snow to the silt and clay bottoms of streams, lakes, and rivers, these substances are eventually converted into oil.

The former theory that oil was formed from the remains of sea creatures and marine organisms has been discarded in recent years, as chemical studies indicate that oil originates from land plants.

Dr. Went, who is Director of the Missouri Botanical Garden in St. Louis, stated that the pungent odor in sagebrush areas of western United States is due to the volatile organic particles produced by sagebrush and carried into the atmosphere. He estimated that the total weight of the airborne substances of the world's vegetation, which eventually find their way into the recesses of the earth, is one hundred and seventy-five million tons annually—sufficient to account for the oil resources of the world.

Torrey Botanical Club. Dr. Seymour Shapiro, of the Brookhaven National Laboratory, lectured on "Factors Controlling the Growth of Preformed Roots in the Stem of the Lombardy Poplar" before members of the Torrey Botanical Club in Larkin Hall, Fordham University, on April 5, 1960. Dr. Shapiro spent several months as consultant to the U. S. Atomic Energy Commission exhibit at the World Agricultural Fair in New Delhi, India.

On May 10, in Schermerhorn Hall, Columbia University, Dr. Arif El-Ani, of Columbia University, will discuss "The Genetics of *Sordaria fimicola* and the Evolution of Homothallism and Heterothallism in Fungi." On May 24, Dr. William C. Steere, Director of The New York Botanical Garden, will lecture on "Botanical Research in Arctic America." The lecture will be preceded by dinner in the Snuff Mill Restaurant at the Garden.

The Society for Economic Botany will hold its first annual meeting on May 21, 1960, at Purdue University, Lafayette, Indiana. On May 22, a symposium on "Integrated Research in Economic Plants—Drugs and Essential Oils" will take place. Among the subjects to be presented will be: "Problems of Exploration" (search for plants of potential value) by Dr. Richard Evans Schultes of the Botanical Museum, Harvard University; "Agronomic and Genetic Studies of Plants of Significance—Crop Development" by Dr. P. K. Knowles of the Department of Agronomy, University of California, Davis; "Problems of Chemical Isolation" by Dr. Robert F. Raffauf of Smith, Kline and French Laboratories, Philadelphia; "Biological Activity Screening: for Drugs" by Dr. K. K. Chen of Eli Lilly and Company, Indianapolis; "Activity Screening: for Essential Oils, Value Determination" by Dr. N. K. Ellis of Purdue University Agricultural Experiment Station.

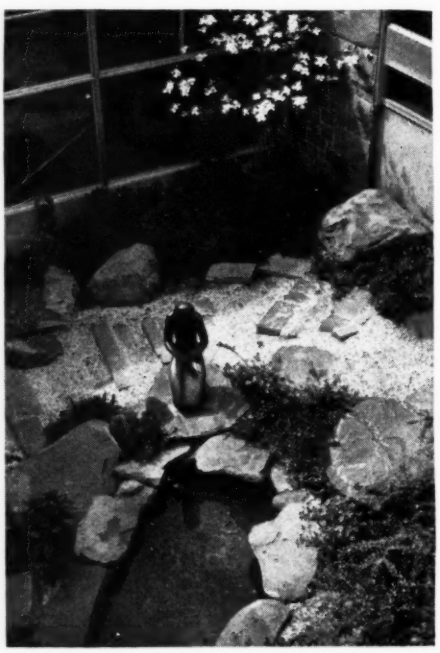
American Horticultural Council and American Horticultural Society have merged into one organization under the latter name. The merger became effective in January 1960. Officers elected to serve for the current year are: Dr. Richard P. White, Washington, D.C., president; Dr. Donald Wyman, Jamaica Plain, Massachusetts, first vice-president; Stuart Armstrong, Washington, D.C., second vice-president; and Miss Olive E. Weatherell, secretary-treasurer.

The directors are: (1960) Dr. Donovan S. Correll, Carl W. Fenninger, Dr. W. H. Hodge, Dr. A. J. Irving, Dr. William C. Steere; (1961) Stuart M. Armstrong, Dr. John L. Creech, William H. Frederick, Jr., Mrs. Francis Patteson-Knight, Dr. Donald Wyman; and (1962) Frederic P. Lee, Dr. Henry T. Skinner, George H. Spalding, Dr. Richard P. White, and Mrs. Anne Wertsner Wood.

The *National Horticultural Magazine*, a quarterly, will be continued under the new name, *American Horticultural Magazine*; and the *Gardeners' Forum* will be published eight times a year.

The American Horticultural Council has functioned for fourteen years basically as a federation of more than one hundred and twenty organizations interested in various phases of horticulture. The original American Horticultural Society has been basically an organization of about five thousand individual members with a few affiliated associations and societies. Through the merger, the efforts and facilities of both organizations will better serve American horticulture.

Innisfree Garden in Millbrook, New York, opened to the public on April 30, 1960, and will be open on Saturdays, 10 a.m. to 4 p.m., and Sundays, 1 p.m. to 5 p.m., through June 26, 1960. In 1955 Mrs. Walter Beck established Innisfree Foundation, which is dedicated to the study of garden art, in memory of her husband, the late Walter Beck. Mrs. Beck died in December 1959.



The very fine planting at the Junior and Senior High School, Cornwall, New York.

Innisfree Garden, built by Mr. Beck, is one of the outstanding examples of garden art in the Americas. Design schools and garden clubs desiring to visit the Garden by special appointment, should address the Trustees, Innisfree Foundation, Millbrook, New York.

The present trustees are Wellington R. Burt, Battle Creek, Michigan; Lester Collins, Washington, D. C.; Francis D. Rogers and Watson Washburn, New York City; and George L. Stout, Boston.

Arnold Arboretum, Jamaica Plain, Massachusetts, has been designated a National Registration Center for new cultivars of ornamental plants with the exception of the genera *Camellia, Fuchsia, Hibiscus, Ilex, Rhododendron,* and *Rosa,* which are assigned to other organizations. The Arboretum has been accredited as a Registration Center by the American Association of Botanic Gardens and Arboretums, to which the responsibility to act as a National Registration Authority was assigned by the American Horticultural Council.

Requests for registration and registration blanks should be sent to Dr. Donald Wyman, Horticulturist, Arnold Arboretum, Jamaica Plain 30, Massachusetts.

"Home Gardens in the Northeast, 1620-1860" is the title of the thirteenth seminar on American culture to be given by the New York Historical Association at Cooperstown, N. Y., July 10-16, 1960.

The course will feature illustrated lectures on garden design in northeastern United States prior to the Civil War and the plants grown in these gardens. It will describe the outward appearance of early American homes and their settings in town and country. A survey will be made of historic British and European prototypes in order to understand the origin and trends of these early American gardens. A field trip is planned.

Dr. Clement Gray Bowers, plant scientist, author, and lecturer, will conduct the course.

As this is an afternoon course, it could be combined with any one of several morning courses: American Furniture to 1850; Pioneer Village Crafts; Advanced Techniques in Genealogical Research; or Conservation of Museum Materials.

The Junior and Senior High School of Cornwall, New York, was one of sixteen schools in the United States to win, in 1957, a national architectural citation from *School Executives Magazine.* The jury of noted judges, in awarding the citation, stated: "commended for preserving and developing the special natural beauties of the site."

The Greater Cornwall Association worked closely with Robert Reimann, landscape architect, who designed the courtyard garden. Mr. Reimann is associated with Sargent, Webster, Crenshaw, and Folley, A.I.A., of Syracuse, New York. The planting was done by Newburgh Nurseries, Inc.

The Cornwall Garden Club, a garden club member of The New York Botanical Garden, has contributed plants and money to further advance the landscaping program.

The statue is an original by Winslow Eaves, Head of the Department of Fine Arts, Syracuse University.

SPRING FLOWER SHOWS

That the public loves flowers and flower shows is a statement no one who watched the throngs at the 1960 spring shows in the Coliseum, New York City, in Convention Hall, Philadelphia, and at Wonderland Park, Revere, Massachusetts, would dispute. Attendance at the International Flower Show, which was constructed in the midst of a very heavy snowfall, was slim on the opening day, March 5; but when the show closed on March 12, it could boast of a record-breaking attendance of two hundred and twenty-five thousand. Snow also hampered the opening of the flower show in Philadelphia, and attendance was below normal the first two days; but on Wednesday, March 9 — and, I understand, thereafter until the closing date of March 12—it was almost impossible to get near enough to the exhibits to be able to study them. The Massachusetts Horticultural Society had to take its eighty-ninth New England Spring Flower Show outside of Boston proper—Mechanics Hall, where the show had been held for many years, was demolished two years ago to make way for a large cultural center that will take five years for completion. Cold weather and huge mounds of snow, which caused traffic to move slowly, did not dampen the enthusiasm of flower lovers, who flocked to Wonderland Park in such large numbers on Sunday, March 13, that the Show Committee opened the gates well ahead of the scheduled hour.

After forcing my way through the crowds at the Boston show on Sunday afternoon—all I was able to get was a bird's-eye view—I returned to the show before its opening hour on Tuesday morning to take notes, only to find that the grandstand and clubhouse were already filled with visitors. And though it was a business day, there were many men as well as women.

In past years, flower shows were spectacular, and visitors gazed in awe at the dramatic, colorful displays. Today's flower shows are more realistic, more "down to earth," to give Mr. and Mrs. Home Owner the opportunity to observe what they can do with their own piece of land. At the New England Flower Show, exhibits were definitely keyed to this purpose: a small formal garden (Mrs. B. Preston Cutler) with lawn and terrace, and clumps of tulips, azaleas, rhododendrons, and dogwood; informal plantings of bulbs, rock garden plants, and azaleas around a waterfall and pool, and of native plants and groundcovers along a brook and pool (Arthur Leiby's Nursery and Kelsey - Highlands Nursery, respectively); an informal patio garden (Bartlett Gardens) planted with low-growing shrubs and bulbs, and enhanced by a little pool and the facade of a rustic building. Any one of these could be copied in whole or in part on someone's property. So could the naturalistic (Weston Nurseries) garden, with its delightful small plantings of rhododendrons, azaleas, andromeda, daphne, primroses and little bulbs; it won the President's Cup for the most meritorious exhibit in the show. The intimate, informal garden (Littlefield-Wyman) happily illustrated the merging of two ways of life—suburbia with rural. Here a lawn surrounded by evergreen and flowering shrubs ended in a brick terrace with barbecue equipment; beyond lay the natural countryside.

The gold-medal herb garden of the National Association of Gardeners (Boston Branch), which was designed by Percy I. Merry, had several distinctive features: a wattle seat, a skep, a topiary yew sundial. Among the many medicinal, fragrant, and culinary herbs, some were in flower—dianthus, foxgloves, madonna lilies, heliotrope, dwarf and climbing nasturtiums. Plants in flower are not often seen in herb gardens at flower shows. The National Association of Gardeners had two other exhibits. The gold-medal informal garden (Cape Cod Branch) featured two old specimens of *Pinus rigida*, a border of lilies, peonies, columbines, dianthus, and candytuft, and a statue of St. Francis in a frame of evergreens. In the silver-medal rose garden (Newport Branch) there was a fine tree rose, 'Dawn O'Lake', with large flowers of velvety dark red.

The Bulkley Medal of the Garden Club of America for "an exhibit of special merit and/or educational value" was awarded to the excellent exhibit set up by the Department of Botany and Bacteriology of Wellesley College (William Jennings, Gardener). It was a collection of ferns and a demonstration on how they are propagated; the latter was so detailed as to include an artificial prothallium. The Beatrix Farrand silver bowl was presented to Cherry Hill Nurseries for a garden display of beautiful rhododendrons and azaleas; the gold medal of the Pennsylvania Horticultural Society to Alexander Heimlich for "an exhibit of special merit stimulating interest in horticulture." Mr. Heimlich showed how a rock garden, with small waterfall and pool, can be constructed at the corner of a small lawn.

Arno H. Nehrling, Executive Secretary of the Massachusetts Horticultural Society, admires the amaryllis bred at the Gardner Museum.

A corner of the herb garden of the National Association of Gardeners at the Boston flower show.

The meritorious exhibit, "Potted Plants for House, Patio, and Greenhouse," of The New York Botanical Garden at the International Flower Show.

The Garden Club of Philadelphia won a blue ribbon with its "garden expressing serenity" at the Philadelphia flower show.

Other exhibits which impressed us were the pruning demonstration by the Arnold Arboretum; the Exbury azaleas displayed for the first time in this country by Wayside Gardens; the superb tree-peonies by Marinus Vander Pol; the miniature daffodils and other little bulbs, including *Scilla tubergiana, Ornithogalum balansae, Cyclamen coum albidum, C. coum roseum,* and *C. atkinsii roseum* by John Thibodeau; and the attractive display of the Bessie Buxton Branch of the American Begonia Society, demonstrating how begonias can be used as house plants and as accessories in contemporary decoration. Also the educational exhibit of cacti and succulents (F. I. Carter & Sons) in which plants, in flower, of *Kalanchoe fedtschenkoi marginata tricolor* and a hybrid kalanchoe, 'Radiant Red', and of *Euphorbia bojeri* and *E. keysii* were effectively employed as accents to brighten the fifty-foot long, table-high display. Two specimens bearing the common names of "long telegraph pole from California" and "corncob cactus" caught the fancy of a group of boys from a private school. The former bore no botanical name—or it may be that I was unable to find the label; the latter was labeled *Euphorbia mammillaris.* All the specimens were healthy, and so crisp and clean that they looked as though they had been scrubbed. The exhibit merited the gold medal it received and the special award from the Massachusetts State Department of Agriculture.

Though I dislike large blooms—any flowers just grown for size, whether dahlias or chrysanthemums or amaryllis—I succumbed to the remarkable amaryllis exhibited by Gardner Museum. There were about seventy-five blooms measuring eight and ten inches across, of strong stem, firm texture, and clear colors; they certainly proved what cultural skill can accomplish. These hybrid amaryllis, bred at the Gardner Museum, received the Antoine Leuthy prize for the best display (commercial or private) of flowering and foliage plants.

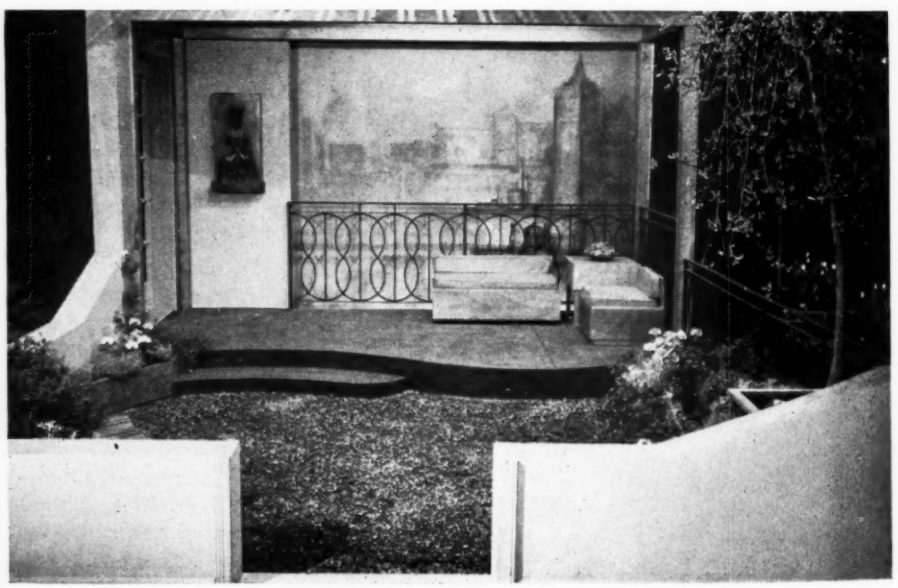
I talked for a few minutes about the amaryllis with Arno H. Nehrling, Executive Secretary of the Massachusetts Horticultural Society and Director of Exhibitions. He has a genuine feeling for these plants, as his father, the late Dr. Henry Nehrling, started to grow and breed them when he was Director of the Public Museum in Milwaukee. When Dr. Nehrling moved to Gotha, Florida, he had the opportunity to plant his seedling amaryllis outdoors, and he was able to do so on an even greater scale on his property in Naples, Florida. Dr. Nehrling's hybrid amaryllis were on the market for a number of years. He also raised many kinds of tropical foliage plants.

Appropriate to the general theme of the New England Flower Show — the exodus from the city to the country and the development of home properties—was a wildflower and bird sanctuary. This exhibit was the joint effort of the Massachusetts Audubon Society, the Garden Club Federation of Massachusetts, and the New England Wild Flower Preservation Society, to inspire people to preserve a little of the natural countryside and the native plants, and to protect the birds. This fascinating exhibit represented a portion of a backyard in which natural beauty had been encouraged: an old white pine, a red-cedar, grey birch, and dogwood with under planting of junipers, native azaleas, blueberries, ferns, trilliums, violets, Solomon's seal, foamflower, partridge-berry, mosses, and lichens. Such planting saves the vanishing natives and offers shelter to the song birds. There was a redwood birdhouse in this sanctuary of such design as to attract several different kinds of birds.

But what about the flower shows in New York and Philadelphia?

The 1960 International Flower Show was one of the best in a number of years, noticeably improved in the variety and quality of the plant material: the well-grown narcissi in the garden of Mrs. Ricardo Gonzales (James Jack, Gardener); the stalwart tulips in the Sterling Forest Gardens display; the marvelous orchids in the Manda exhibit; the fine roses in the Jackson and Perkins garden. Some of the plants exhibited in the amateur classes for gesneriads, cyclamen, begonias, African violets, cacti and succulents, and orchids were especially commendable.

Outstanding in the opinion of judges and visitors was The New York Botanical Garden's very attractive, educational exhibit of "Potted Plants for House, Patio, and Greenhouse." In conception and execution, this was a "first-class job." Plants in the windows—the show cases—of a low, white house from which one looked out on plants on a patio (moved there for the summer from the small greenhouse), and plants in the greenhouse where they were being grown and rehabilitated—all illustrated how the home owner can use plants to the best advantage in decorating his home within and without. Adding to the exhibit's educational value was the remarkable variety of plants and their high quality, and the printed matter on pot plant culture prepared by Louis P. Politi, Horticulturist, for distribution during show week. To Mr. Politi and his department, and to Vincent Rampino, Superintendent of Buildings and Grounds, and his department belongs the credit for this exhibit which was awarded the Bulkley Medal of the Garden Club of America, the T. A. Weston Trophy, and the Horticultural Society of New York Trophy.



Simplicity was the keynote of the city roof-garden of the Four Counties Garden Club at the Philadelphia flower show.

"Joy of the Waters," the formal garden exhibited by Styer's Nurseries at the Philadelphia flower show, could be readily adapted to a home property.

The Garden Club of America's many horticultural classes were keenly contested; so were the artistic arrangement classes, with the coveted Fenwick Medal being presented on the final day of the show to Mrs. Oliver A. Vietor and Mrs. Gray McW. Bryan of the Rumson Garden Club.

On entering the flower show in Philadelphia, I missed the long vista down the main aisle of Convention Hall—of acacias, of dogwoods, of orchids, as it had varied from year to year. The center of the Hall was occupied by "Dancing Waters," multi-colored streams of water leaping and cascading in rhythm to music. The series of fountains was enclosed within a high wooden fence around which were beds of well-grown, colorful tulips.

The Bulkley Medal of the Garden Club of America was awarded to the Morris Arboretum (Dr. John M. Fogg, Jr., Director) for a "reasonably complete collection of the many cultivated forms of *Hedera helix*," an exhibit which interested the gardening public. Many visitors jotted down cultivar names in their notebooks. Notebooks were in use, too, at the exhibit of pelargoniums—miniature, variegated-leaved, ivy-leaved, scented-leaved—staged attractively by Ambler Junior College of Temple University; this was formerly the Ambler School of Horticulture.

The fragrance garden for the blind of the Philadelphia Unit of the Herb Society of America drew many visitors. The borders, constructed of railroad ties to a level that permitted the plants to be easily touched or smelled, were complete in every detail with Braille labels on the plants and directions in Braille on the guide-rail before a corner. The African Violet Society had a fine display of profusely flowered plants and a demonstration on propagation. The member on duty was kept very busy answering one question after another. The American Gloxinia Society and the American Begonia Society were also represented.

Garden clubs from the suburbs of Philadelphia enter wholeheartedly into the spirit of the flower show — not only in setting beautiful tables with fine appointments and artistic floral arrangements, in keeping with period furniture, and in making artistic arrangements in niches, but in putting together well-designed, small gardens. This year their schedule called for a "section of a garden expressing serenity," and they admirably met the schedule. The gardens were charming, with top honors going to the Garden Club of Philadelphia. Their schedule also called for a "city garden, roof or backyard—some plant containers required as part of the scene." The blue ribbon was awarded to the garden entered by the Garden Club of Wilmington; it was well done. The city roof-garden of the Four Counties Garden Club, that won second place, appealed to me because of its simplicity.

I am interested in native plants, so I always look for Vick's Wildgarden exhibit. This year in a natural woodsy setting of birch, dogwood, rhododendrons, azaleas, and mountain-laurel, water flowed from an old, abandoned springhouse into a brook and tiny pools. Growing in the leaf-strewn floor of the woods were dainty wild flowers—orchids, trilliums, arbutus, hepaticas, violets, ferns, and a host of others.

Across the aisle from Vick's "Joy of the Wild" was "Joy of the Waters" created by Styer's Nurseries. It was a formal garden, dominated by a huge tree whose shade would make the terrace an inviting place on a balmy spring or warm summer day. The little statue in back of the small pool was enchanting. This garden, particularly well designed by someone who has discriminating taste and an appreciation of plant material, could readily be adapted to a good-sized suburban property.

Conard-Pyle's pretty rose garden or "Rose Walk," as it was named, contained over two hundred Hybrid Teas, Floribundas, and Grandifloras. Conard-Pyle displayed also an eight-by-twelve-foot garden, entitled "Suburban Living in Miniature." Everything was built to scale—model ranch-type house, driveway, walks, lake, deciduous and evergreen shrubs, shade trees, and four stepped-down terraces planted with miniature bush and tree roses. Children as well as adults were fascinated by this "doll-size" house and garden.

Doors had hardly closed upon the last visitors to these flower shows before exhibitors began dismantling their displays, trucks carted plants and props away, clean-up squads worked fast to remove debris, show managers and committees tallied their records. Then, within a matter of days, managers, committees, and exhibitors started their plans for the next show. A spring flower show is a full year in the making.

D.E.H.

MORE NEWS AND NOTES

1961 All-America Rose Award Winners are 'Duet', a Hybrid Tea, and 'Pink Parfait', a Grandiflora. These are the fifty-fourth and fifty-fifth roses to win this award since the testing program was initiated in 1938, indicative of the fact that rose introductions must pass high standards of vigor, disease-resistance, form, color, and so on, in the All-America trial gardens which are located in various parts of the United States.

'Duet' is a bi-color, in which the soft salmon-pink of the inner surface of the petal blends with the rosy crimson of the reverse. 'Pink Parfait', the third in the Grandiflora class (established five years ago) to win the All-America Rose Award, bears numerous flowers, shading from dawn-pink to deep rose, on a large and vigorous plant.

The New York Botanical Garden has been designated an All-America Rose Selections Garden, where the All-America roses may be seen.

Above. Grandiflora rose 'Pink Parfait'. Left. Hybrid Tea rose 'Duet'.

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245 Brimfield Road Wethersfield, Conn.

New Garden Mums. Bristol Nurseries, Inc. is introducing a little button-type chrysanthemum, 'Chocolate Drop'; its oxblood-red to chocolate-maroon flowers are borne on long sprays, nice for cutting. Their other new varieties include 'Flaming Pillar', a late-flowering decorative; 'Moonlight Spoon', an early-flowering spoon variety in soft primrose; 'Sparkling', another decorative, in rose-geranium pink; and 'Bronze Gremlin', an early-season walnut-bronze pompon —a mound of color by September 15.

George J. Ball Inc., is offering "foot-ball" mums for gardens under the name of "Harvest Giants" in white, apricot, golden-yellow, and bronze-red. Cornelius Ackerson, past president of the National Chrysanthemum Society, Inc., and editor of its Bulletin, tested them in his New Jersey garden last year and rates them high.

Dr. Louis Otto Kunkel, plant pathologist of international repute, a member of the Board of Managers of The New York Botanical Garden since February 27, 1951, and of the Scientific Committee since May 1953, died in Newtown, Pa., on March 20, 1960 at the age of 76. Dr. Kunkel had been a plant pathologist with the Rockefeller Institute of Medical Research for a number of years at the time of his retirement in 1950. He established the Division of Plant Pathology at the Institute's former branch in Princeton, N. J., in 1932 and engaged in extensive research on the relationship of viruses to plant diseases.

He was born in Mexico, Mo., and received his Bachelor's and Master's degrees from the University of Missouri, and his doctorate in botany from Columbia University. After a two-year fellowship for study abroad, Dr. Kunkel became a plant pathologist with the Bureau of Plant Industry, U.S.D.A., and later Associate Pathologist for the Hawaiian Sugar Planters' Association on the problem of mosaic disease of the sugar cane. Dr. Kunkel's investigations, while he was on the staff of Boyce Thompson Institute for Plant Research, contributed to the knowledge of mosaic diseases of sugar cane, tobacco, and Indian corn.

The Board of Managers at its meeting on March 21, 1960, adopted a resolution recording its profound sorrow at the death of its associate who had had a long and distinguished career.

Dr. Ezra J. Kraus, well-known plant scientist, died at Corvallis, Oregon, on February 28, 1960, at the age of seventy-four. After he had served as plant physiologist at Oregon State College for eleven years, he joined the staff of the University of Wisconsin in 1917; in 1934, he became chairman of the department of botany at the University of Chicago.

Dr. Kraus helped to develop the weed control spray 2,4-D, did pioneer work on plant growth regulators, and developed new strains of chrysanthemums. Since his retirement in 1949, when he returned to Oregon State College as visiting professor in botany, his interest has centered on the development of new varieties of ornamental plants.

His Chicago strain of chrysanthemums was developed in experiments which he conducted on the Lasker estate in Lake Forest, Illinois. In 1953, Mrs. Albert D. Lasker presented New York City with some five thousand plants of these chrysanthemums in memory of her mother, Mrs. Sara J. Woodard.

Dr. Kraus was the recipient of awards from the Garden Club of America, the Men's Garden Clubs of America, the American Pomological Society, the American Association of Nurserymen, and others. He was a past president of the Botanical Society of America, the American Society of Horticultural Science, and the American Society of Plant Physiologists.

Visitors at The New York Botanical Garden in recent months:

Dr. Harve Carlson, National Science Foundation, Washington, D.C.
Dr. A. C. Smith, Smithsonian Institute, Washington, D.C.
Dr. Charles D. Michener, University of Kansas, Lawrence.
Howard S. Irwin, Jr., Dept. of Botany, University of Texas, Austin.
Dr. Ferdinand Bohlmann, Director of Organisch - Chemisches Institut, Technische Hochschule, Berlin.
Boris Anzlowar, Director of the Science Information Center, Ciba Pharmaceutical Co., Summit, N. J.
Beatrice Cashman, Garden Editor, *Better Homes and Gardens*, Des Moines.
Mr. and Mrs. Tugo Tateoka, Japan.
Dr. Paul C. Hutchison, University of California, Berkeley.
Paul F. Frese, Director of Public Information and Education, Sterling Forest Gardens, Tuxedo Park, N. Y.
Margaret Meuse, Sterling Forest Gardens, Tuxedo Park, N. Y.
Dr. William L. Stern, Dept. of Forestry, Yale University, New Haven.
Prof. Kenton Chambers, Dept. of Botany, Yale University, New Haven.
Dr. John M. Fogg, Jr., Director, Morris Arboretum, Philadelphia.
Mr. and Mrs. Alex McDonald, Chatham, Ontario.
Dr. M. A. Johnson, Rutgers University, New Brunswick.
Dr. S. M. Bricks, University of Rhode Island, Kingston.
Mildred F. Petit, Librarian, Kingwood Center, Mansfield, Ohio.
Dr. Robert F. Duell, Farm Crops Dept., Rutgers University, New Brunswick.
Dr. F. R. Forsberg, Washington, D.C.
Dr. Lyman B. Smith, Smithsonian Institute, Washington, D.C.
Dr. Pierre Dansereau, Institut Botanique, Université de Montréal, Montréal.
Dr. R. M. Schuster, University of Massachusetts, Amherst.
Lorna Maitland, artist, London, England.
Luz Valcárcel, Lima, Peru.
Dr. F. W. Kavanagh, Eli Lilly and Co., Indianapolis.
Dr. Joseph Thomas, St. Barnabas Hospital, New York City.
Dr. S. Stevenson, St. Barnabas Hospital, New York City.
Dr. William Klomparens, Research Division, The Upjohn Co., Kalamazoo, Mich.
Dr. L. W. Clausen, College of Pharmacy, Columbia University, New York City.
Dr. S. M. Siegel, Union Carbide Research Institute, White Plains, N. Y.
K. C. Coleman, Union Carbide Development Co., White Plains, N. Y.
H. F. Robertson, Union Carbide Develop- Co., White Plains, N. Y.
Dr. W. J. Crotty, Dept. of Biology, Washington Square College, New York University, New York City.
Dr. Tom Stonier, Rockefeller Institute for Medical Research, New York City.
Dr. N. Valanju, Rockland State Hospital, Orangeburg, N. Y.
Dr. Leonard Piccoli, School of Pharmacy, Fordham University, New York City.
T. M. Traroe, Institut National Hygiene, Conakry, Republic de Guinea.
Dr. K. J. Zozol, Republic de Guinea.
Mrs. Rod Smith, Hobart, Tasmania.

BOOK REVIEWS (from page 115)

sistant high-molecular structures and complicated, rare molecules such as antibiotics and vitamins, resistant metabolites such as plant cell-wally materials, and others producing these antibiotics and vitamins. The book is remarkably up-to-date; e.g., it has a good outline of Lochhead's revolutionary studies of the nutritional interrelationships of the quantitatively most important groups of soil bacteria, and it abstracts directions from recent papers on how to isolate amoebae and bacteriophages. The methods outlined for testing bacteria en masse for antibiotic production are a good introduction for the beginner. There are many well-printed diagrams and illustrations.

Soil science, unfortunately, is something of a museum of physiological antiquities; this moldiness infects portions of the book; thus "Thornton's Standardized Medium" for

isolating soil bacteria and a "modified Crone's solution" for higher plants are set forth. A second edition, cleansed of obsolete recipes, and enlarged to cover such important topics as the measurement of the persistence in soil of chemicals used to control plant diseases, should be warmly welcomed.

S. H. HUTNER
Haskins Laboratories
New York, N. Y.

BREEDING FIELD CROPS. John Milton Poehlman. 427 pages, illustrated, indexed. Henry Holt and Company, New York, N. Y. 1959. $8.50.

The author indicates this book to have been written principally for an introductory course in crop breeding and possibly as a reference book for more advanced students. Stated objectives are review of basic principles, presentation of methods of procedure, breeding of specific crops, objectives and problems and propagation and maintenance of improved varieties. Crops considered are wheat, oats, barley, rice, flax, tobacco, soybeans, corn, sorghum, cotton, sugar beets and forage plants.

The book is ideally suited for a beginning course in field crops breeding. It has been written at the desired level and has excellent coverage of the most pertinent subject matter. The information presented for the various crops has been well reviewed by competent breeders and is well organized. The teacher using the text may need to supplement information at various points, depending upon emphasis, since it is not possible for such a text to be exhaustive.

Numerous illustrations, photographs, and diagrams are excellent and appropriate. Reference lists accompany each chapter and a glossary of technical terms is appended. The volume is a valuable addition to crop breeding texts and should prove interesting and useful to all students of plant improvement.

D. C. SMITH
Department of Agronomy
University of Wisconsin
Madison, Wisconsin

PLANT PHYSIOLOGY, A Treatise. Volume II. Plants in Relation to Water and Solutes. F. C. Steward, editor. xvii—758 pp. Illustrated and indexed. Academic Press, Inc. New York. 1959. $22.00.

The tremendous expansion and complexity of the interlocking disciplines comprising plant physiology has suggested that advanced texts be written by more than one author. Volume II of Professor Steward's *Plant Physiology* is part of a projected six-volume, seven-part treatise on all aspects of plant physiology.

The choice of topics for the volume under review is excellent; the eight authors are all recognized authorities in their respective fields, and the book is very well edited. The chapters are, essentially, long reviews of the literature with an adequate amount of interpretation and synthesis. The research worker and the teacher will undoubtedly use this treatise extensively.

As is true for books on all rapidly advancing scientific endeavors, *Plant Physiology* will soon be out of date. Since identical subject matter is reviewed almost yearly in several "Annual Reviews" as well as in the *Encyclopedia of Plant Physiology*, the cost of this set of books seems excessive.

RICHARD M. KLEIN

COMPLETE BOOK OF HOUSE PLANTS. Andree Vilas Grabe. 126 pages, illustrated, indexed. Random House, Inc., New York. 1958. $2.95.

JUST ADD TO WATER, SPRINKLE OR SPRAY!
NET WEIGHT 5 POUNDS
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The original instantly soluble high-nutrition plant food: Nitrogen 23%, Phosphoric Acid 21%, Potash 17%, plus important trace elements. Made only by RA-PID-GRO Corp., Dansville, N. Y.

With the increasing interest in the use of plants in the home, this book is another must, especially for the amateur. It is designed to give concise and complete information in a clear and understandable manner.

The book is divided into two parts. Part I is devoted to the care of house plants in general, a primer of instructions. Though it contains information similar to that found in many other books, it differs from them in one respect—it deals only with those easily grown in the home, not in the greenhouse.

There are eight chapters each treating a single subject: "The Potting Mixture"; "Pots; Potting, Repotting"; "Light"; "Watering, Washing, Humidity"; "Temperature and Fresh Air"; "Plant Food"; "Pests"; "Propagation."

Part II, by far the more important, is a picture dictionary which gives facts about the care, cultivation, and propagation of nearly three hundred plants, listed alphabetically by their popular, as well as their botanical names. With each plant, there is a photograph and description; the facts are there, easy to locate, and easy to read. The photographs are very clear, and, with descriptions simply and clearly stated, they comprise a fine reference book.

MARY F. JOHNSON
Pompton Lakes, New Jersey

THIS IS NATURE. Richard W. Westwood (Selected and Edited by). Brief notes on 38 authors. 214 pages, illustrated, including line drawings by Walter W. Ferguson. Thomas Y. Crowell Co. New York. 1959. $5.95.

There was a time when magazine subscribers bound their favorite periodicals annually, with shelf-room being no particular problem. But times change and recent years have seen an interesting development — the magazine that becomes a book by having its best or most popular articles reprinted between hard covers. Such is *This Is Nature*, described in the subtitle as "Thirty Years of the Best from *Nature Magazine*." It is an especially appropriate memorial anthology just now, when *Nature Magazine* is going out of existence by being merged with *Natural History*.

Nature Magazine has always held a distinguished place among American magazines devoted to natural history. It has attracted good naturalists and good writers (sometimes but not always synonymous terms) and has published a high percentage of popular yet accurately observed natural history articles as against the amateurish accounts of wild pets which, appealing as they occasionally are, inevitably lower the level of a magazine. Here are articles by Carl G. Hartman, Edwin Way Teale, William Beebe, Robert Cushman Murphy, Alan Devoe, E. Laurence Palmer — to mention only half a dozen out of the almost two-score authors represented. The anthology contains many striking photographs and a good series of the always-delightful drawings by Walter W. Ferguson. *This Is Nature* is a happily-conceived souvenir of a vanished magazine that had many devoted readers.

WILLIAM BRIDGES
Curator of Publications
New York Zoological Society

EVERGREEN AND FLOWERING SHRUBS FOR YOUR HOME. Katharine M-P. Cloud. 248 pages, illustrated, indexed. Greenberg, Publisher, New York. 1957. $4.95.

The many illustrations in this book on shrubs gives the home owner good ideas to carry out on his own grounds. The before and after pictures are especially interesting.

Most of the houses shown are modern and small in keeping with today's trend.

The book is divided in four parts with general cultural directions and ways of using shrubs at the beginning. A special chapter on roses is worthwhile, giving a list of species roses which can be used as shrubs or hedges.

Part 2 is devoted to evergreen shrubs listed alphabetically so that easy reference can be made. A hardiness map at the front of the book explains the zone number following the name of each shrub. Varieties and ways of using them are given in each instance, also pests and how to control them. Propagation methods are specific here, following general rules in the chapter on propagation in Part 1.

Flowering shrubs are treated in the same way in Part 3. One is glad that proper pruning is stressed, and the illustration on page 26 of a twenty-four-year-old forsythia deserves praise for its natural beauty.

The last section is made up of lists which doubtless will prove to be the most valuable part of the book to many gardeners. A long list of shrubs for partial shade is helpful but, again, the question arises what degree of shade. Pyracantha will grow in partial shade but does not fruit well there. Since the berries are its main attraction, one wonders whether this plant should be included in this list. Shrubs for fall color and shrubs to attract birds will interest many. This practical book is worth a place on the gardener's book shelf.

ESTELLE L. SHARP
Berwyn, Pennsylvania

Recent Additions to the Library

Bigger's Handbook of Bacteriology. F. S. Stewart. 611 pages, illustrated, indexed. The Williams & Wilkins Company, Baltimore, Maryland. 1959. $8.00.

Central Desert of Baja California, The. Homer Aschmann. 315 pages. University of California Press, Berkeley, California. 1959. $5.00.

Chemistry of Plant Gums and Mucilages. F. Smith and R. Montgomery. 627 pages, illustrated, indexed. Reinhold Publishing Corp., New York, N. Y. 1959. $18.00.

Grasslands. Howard B. Sprague (Ed. by). 424 pages, illustrated, indexed. American Association for the Advancement of Science, Washington, D.C. 1959. $9.00. $8.00 to members of AAAS.

Grass Productivity. André Voisin. 353 pages, illustrated, indexed. Philosophical Library, Inc., New York, N. Y. 1959. $15.00.

Production of Field Crops. T. K. Wolfe and M. S. Kipps. 5th Edition. 653 pages, illustrated, indexed. McGraw-Hill Book Company, Inc., New York, N. Y. 1959. $8.50.

A REVIEW (from page 107)
preference to recent publications or editions: e.g., Solereder's 1899 treatise on anatomy is cited rather than Metcalfe and Chalk's 1950 *Anatomy of the Dicotyledons*; Brown and Panshin's 1934 *Identification of the Commercial Timbers of the United States* is listed in lieu of their 1940 or 1949 editions. Pertinent works are omitted in some instances: e.g., Kribs' work on commercial foreign timbers in the United States, Spalt and Stern's recent survey of African timbers, and Little's check-list of the woody plants of the United States. These and other recent publications would have helped the author to make his work really a second revised edition and would have improved his selection of botanical names.

Because the description of each timber begins on a new page, short descriptions occupy only a fraction of the page. The large blank spaces that result are highly distracting and do not improve the appearance of the book. Aside from the addition of a number of new wood descriptions and the photomicrographs, this edition is little improved over the 1949 edition.

The large number of orthographic errors, especially in scientific names, is unpardonable in a second edition. It is disheartening to have to report thus on any published work.

LETTERS TO THE EDITOR

The cover photo of the March-April issue is especially lovely. I've seen the garden when it was as beautiful as its picture.

There seems to be an unusual number of articles of special interest, probably because in one way or another they relate to personal experiences of my own.

Most interesting of all, for this reason, is the article concerning the Meilland rose establishment. When I was going to France in the summer of 1956 as the guest of the House of Houbigant, I expressed a strong desire to visit a perfume factory in Grasse and the Meilland greenhouses at Cap d'Antibes. Houbigant made the necessary arrangements. I was given a letter of introduction to M. Smith of Grasse. In the company of M. and Mme. Smith (he was English, she French) I visited both Grasse and Cap d'Antibes.

Francis Meilland was undergoing an operation the day of our visit, but his father made a most delightful host. He showed us through several of the large greenhouses; then took us to the administration building. There the official photographer showed us many photographs of the Meilland roses.

The cedar of Lebanon at Brimfield Gardens Nursery and the dwarf global-shaped white pine, at the extreme left, are the same age—thirty years old.

While we were in the greenhouses, "Pere" Meilland cut rose after rose, presenting each to me with a friendly smile. Among them was the recently named 'Grace de Monaco' and 'Peace', called 'Mme. Meilland' in France. When we left, I had an armful. As I was leaving the next day for England, I gave the roses to Mme. Smith in gratitude for a most wonderful day—from 9 A.M. to 5 P.M. or thereabouts.

On our return to my hotel in Nice, the skies opened up. It was the first rain in over two months, I was told. The Smiths had reason to be pleased.

Thank you for pleasant memories .

ELISE L. BOWLES
(Mrs. Charles R. Bowles)
Yonkers, New York

I was happy to see Mr. Swift's article "Vizcaya" in the March-April issue of *The Garden Journal*, —and the excellent pictures— but very sorry to note that no mention had been made of the creator of all that beauty, both indoors and outdoors of the villa. It seems to me that Paul Chalfin, my uncle, should have been given a little credit.

"Vizcaya" was his masterpiece: the glorious gardens were all executed under his guidance and from his plans; the art treasures were purchased abroad by him for Mr. Deering and selected to fit the preconceived plan. Mr. Deering had been in favor of Spanish architecture, but Uncle Paul persuaded him to use Italian instead. The choice of the material used for the palazzo (and even the name "Vizcaya") were my uncle's choices. The interiors, also, were the result of his genius — the specially made lighting fixtures, curtains, all small and large details.

When the Dade County Art Museum came into being, Mr. Chalfin was the only one who knew the value and history of "Vizcaya's" contents, and he was thus engaged to make the inventory before it was opened to the public. Mr. Chalfin died a year ago at the age of eighty-six.

BRUCE G. CHALFIN
Plantation Gardens
Rustburg, Virginia

We have a fine cedar of Lebanon here at Brimfield Gardens Nursery. It is about forty feet high and thirty years old, and bore a few cones for the first time in 1958. They were ripe in the fall of 1959. Two squirrels nibbled at the cones the first fall but, finding them too green and resinous, left them on the tree. I got them down ahead of the squirrels this fall and sowed them. I hope they are viable.

The scion, when this tree was grafted, came from one of the trees at the Arnold Arboretum and is of the hardy type. It was raised from seed that Prof. Charles Sargent, then director at the Arboretum, had brought over—some fifty years ago—from the cold mountains of Asia Minor. I am enclosing a picture which may interest readers of *The Garden Journal.*

The cedar of Lebanon becomes a very picturesque old tree, not unlike an old white pine, and should be planted much more frequently than it is.

ROBERT MARSHALL
Wethersfield, Connecticut

ERRATUM: March-April issue, page 73, 4th paragraph, first line, should read "*Monarda didyma* and a third *Monarda*, namely *M. punctata* . . ."

SUTURES FOR A WOUNDED TREE

Another example of Scientific Research at work

A storm sweeps down leaving in its wake a split tree, years of stately growth and beauty shattered in a few minutes. There was a time when the axe was the only solution to this problem but today it is not always fatal. Where the break is not too severe, scientific tree care, like modern surgery, has developed a technique of "suturing" that not only closes the wound but permits the tree to regain its normal strength and vigor. "Sutures" in order to be effective must be promptly and skillfully applied so that the break is sealed against infection and the trunk and large branches sway as a whole, not independently. This exacting process calls for trained technicians and precision instruments which is the reason why "Bartlett" has spent years in the research and development of techniques and materials for this important branch of shade tree care.

Storm damage claims thousands of trees each year many of which could have been saved by proper bracing and cabling. Don't wait until the injury occurs, call a Bartlett Tree Expert today for sound advice on how to protect your valuable shade trees the Scientific Way. His local experience backed by the knowledge and technical advice of the Bartlett Tree Research Laboratories is available for this and all other types of tree problems.

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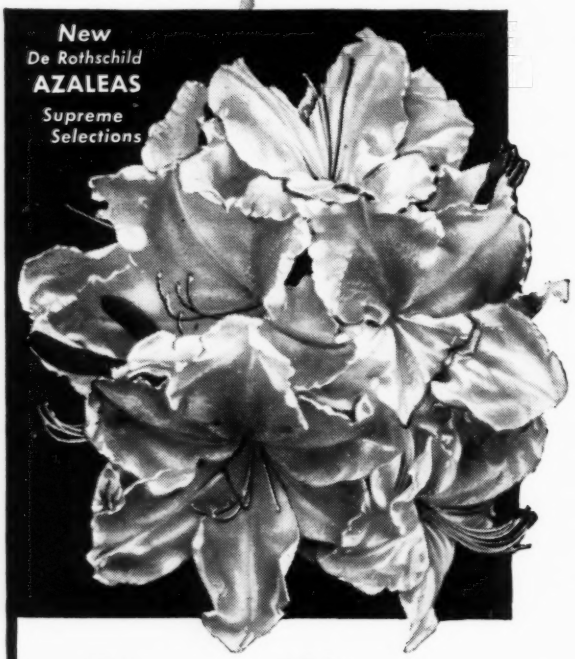
New HYBRID TEA ROSE, *Dawn.* A long stemmed beauty. Colors are a treat to behold; pink, salmon and apricot with a hint of yellow tint. Medium sized, graceful plant of unusual strength. Exquisite when cut.

New FLORIBUNDA ROSE, *Allgold* represents a gold mine of satisfaction to the rose-loving gardener. From every corner of the world, we've received glowing praise of its true golden color; unfading from bud to resplendent maturity. Unmatched for hardiness, too.

New SINGLE ENGLISH ROSES offer a nostalgic charm that is as precious as it is unusual in today's gardens. Fragrant, graceful, easy to grow, these golden-zoned beauties come in all shades from creamy-yellow to deepest salmon.



New De Rothschild AZALEAS
Supreme Selections

The NEWEST, *most beautiful* SHRUBS *and* TREES

New AZALEA, *de Rothschild.* Wayside's exclusive *Supreme Selections* represent the finest hybrids developed by master plantsman, Lionel de Rothschild. Blooms range from purest white to delicate pastels to dramatic gold, red and orange. Their hardiness is unrivaled.

New ALTHEA, *Blue Bird* brings sky-blue beauty to your borders with magnificent single blossoms that measure a full 5 inches in diameter. They have a clarity of color never seen in any other Althea. Plant in sun, sit back, and watch Blue Bird flourish.

New ABELIOPHYLLUM, *Distichum,* called white forsythia, is a most beautiful conversation plant. Palest pink when buds open, this 3½ foot, sun-worshiping shrub soon turns into the most welcome snow-white Spring flower-drift you've ever seen.

New VIBURNUM, *Pink Beauty* is a pink Tomentosum that surpasses all other shrubs for delicate and bountiful beauty. Flowers open white and gradually turn to clear, sunset pink. Amazingly, it prefers only the simplest of care.

New MALUS *Red Jade.* A two-season beauty that originated in New York's famous Brooklyn Botanic Gardens. In Spring, this softly weeping tree is a flower-fall of white; in Autumn, the fruit ripens to striking scarlet, a marvelous display.

New ROBINIA, *Friesia* makes a bright three-season showing as patio or lawn tree. Spring brings pale yellow leaf buds that open to rich gold plumes, slowly turning copper as Fall approaches. Thorns gleam red; the shoots, orange—unforgettable color fantasy.

NEW HARDY PHLOX
Starfire

The NEWEST *and hardiest* PERENNIALS

New DICENTRA, *Bountiful* is a non-stop bloomer. From bud-break in Spring through mid-summer, it produces masses of fuchsia-red flowers that are almost double the size of the common Plumy Bleeding Heart. Early Fall to frost, blossoms again cover its handsome dark green foliage.

New GENTIANA, *Makinoi,* makes a lovely spot of color in late Summer and early Fall gardens. A deep Gentian-blue, celebrated in song and story, new Oriental-import *Makinoi* grows about 12 inches tall and has been proven exceptionally hardy by Wayside testing.

HOSTA, *Thomas Hogg.* An unusually handsome border plant. Large, glossy leaves of richest green are dramatically edged in silver. In early Fall, its lovely lavender flowers are a charming accent.

New PHLOX, Symons-Jeune Hybrids, created in England, bring to your Phlox collection extreme hardiness, exquisite clarity and variety of color plus extraordinary abundance of blooms shading from white to brilliant orange-scarlet and deep salmon-pink.

New PHLOX, *Starfire,* a sure-fire hit in any man's garden, brings you right into the collector's class among phlox-men. *Starfire* is the only true-red Phlox. Rare as a true-blue friend and as easily cultivated as the most casual of acquaintances.

New SEDUM, *Indian Chief* provides a gorgeous spot of color in your Fall border. All during the Spring and Summer it offers an oasis of cool, gray-green foliage; then in cooler weather, it tops itself with red-copper blooms that would be stunning against a background of Wayside Chrysanthemums.

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